S. B. JAIN INSTITUTE OF TECHNOLOGY, MANAGEMENT & RESEARCH, NAGPUR.
(An Autonomous Institute, Affiliated to RTMNU, Nagpur)
DEPARTMENT OF EMERGING TECHNOLOGIES (AI&ML and AI&DS)

COURSE SYLLABUS

FOR

SEMESTER – VII

B. Tech.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(W. E. F. 2024-25)

Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM701T	AI in Healthcare & Finance	3	0	0	3	40	60	100	3

Course Objective
To impart adequate knowledge of Artificial Intelligence and Machine Learning in Healthcare and Finance.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Remember:** Recall the fundamental concepts of AI in healthcare and finance, including the types of AI, their applications, and the ethical considerations involved.
CO2	**Understand:** Interpret the principles of AI in healthcare and finance, including the data sources, algorithms, and models used in AI systems.
CO3	**Apply:** Apply AI techniques to healthcare & financial problems including data preprocessing, feature selection, and model selection.
CO4	**Evaluate**: Evaluate the impact of AI on healthcare & finance domain including the benefits, risks, and challenges of AI.
CO5	**Create:** Design AI systems for healthcare & finance domain including the data collection, model training, and deployment of AI systems

SYLLABUS
Unit 1: Introduction to AI in Healthcare: Overview of AI in healthcare, Types of AI and their applications in healthcare, Ethical considerations in AI in healthcare. **Data Sources and Preprocessing:** Data sources in healthcare, Data preprocessing techniques, Feature selection and extraction.
Unit 2: AI Models in Healthcare: Types of AI models used in healthcare, Model selection and evaluation Interpretability and bias in AI models.
Unit 3: Applications of AI in Healthcare: AI applications in medical imaging, AI applications in drug discovery, AI applications in clinical decision support. **Challenges and Opportunities of AI in Healthcare:** Benefits and risks of AI in healthcare, Regulatory and legal considerations, Future directions of AI in healthcare.
Unit 4: Introduction to AI in Finance: Overview of AI and its applications in finance, Machine learning techniques and their relevance in finance, Case studies of AI in finance
Unit 5: AI for Trading: Algorithmic trading and its advantages, Predictive modeling for trading, High-frequency trading and its challenges.

Unit 6: AI for Investment Management: Portfolio optimization using AI, Robo-advisory and its impact on investment management, Sentiment analysis and its use in investment decision-making.

Text Books:

1. Artificial Intelligence in Healthcare Industry, Jyotismita Talukdar, Thipendra P. Singh, and Basanta Barman, 2023, published in Springer.
2. The AI Revolution in Medicine: GPT-4 and Beyond, Peter Lee, Carey Goldberg, and Isaac Kohane, 2023, published in Pearson.
3. Artificial Intelligence in Finance, Yves Hilpisch, 2020, published in O'Reilly Media.
4. Artificial Intelligence in Finance and Accounting, Tariqullah Khan, 2023, published in Springer.

Reference Books:

1. Artificial Intelligence in Healthcare, Adam Bohr, 2020, published in Academic Press.
2. Artificial Intelligence (AI) and Finance, J. Joshua Thomas, 2020, published in Springer.
3. Machine Learning for Finance: Principles and practice for financial insiders, Jannes Klaas, 2021, published in O'Reilly Media.

Revision	BOS Meeting	Date	W. E. F
--	5th	13-01-2024	2024-25

Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM701P	AI in Healthcare & Finance Lab	0	0	2	1	25	25	50	--

Course Objective
This course will develop theoretical and computational approaches to AI in Healthcare & Finance

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply:** Apply AI techniques to healthcare & financial problems including data preprocessing, feature selection, and model selection.
CO2	**Evaluate**: Evaluate the impact of AI on healthcare & finance domain including the benefits, risks, and challenges of AI.
CO3	**Create:** Design AI systems for healthcare & finance domain including the data collection, model training, and deployment of AI systems

A minimum of eight practicals to be performed based on the theory course AI in Healthcare & Finance [PECAM701T]

Suggested References:

1. Artificial Intelligence in Healthcare, Adam Bohr, 2020, published in Academic Press.
2. Artificial Intelligence (AI) and Finance, J. Joshua Thomas, 2020, published in Springer.
3. Machine Learning for Finance: Principles and practice for financial insiders, Jannes Klaas, 2021, published in O'Reilly Media.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM702T	Pattern Recognition	3	0	0	3	40	60	100	3

Course Objective
The course enables the students to understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms and to provide a knowledge of feature extraction methods, feature evaluation, and data mining on real life.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Illustrate the need and significance of mathematical fundamentals in pattern recognition to solve real-time problems.
CO2	**Apply:** Apply supervised learning algorithms for solving problems.
CO3	**Apply:** Apply unsupervised techniques for clustering data without prior knowledge.
CO4	**Create:** Design pattern recognition models to extract interesting patterns from structured data like graph, syntactic description etc.
CO5	**Understand:** Illustrate the impact of dimensionality reduction on the design of intelligent models.

SYLLABUS

UNIT I: Classification
Overview of pattern recognition, Discriminant functions, Supervised learning, Parametric estimation, Maximum likelihood estimation.

UNIT II: Pattern Classifier
Bayesian parameter estimation, perceptron algorithm, LMSE algorithm, problems with Bayes approach-Pattern classification by distance functions-Minimum distance pattern classifier.

UNIT III: Unsupervised Classification
Clustering for unsupervised learning and classification, Clustering concept, C-means algorithm, Hierarchical clustering procedures, Graph theoretic approach to pattern clustering, Validity of clustering solution.

UNIT IV: Structural Pattern Recognition
Elements off or mal grammars, String generation as pattern, Syntactic description, Parsing, Stochastic grammars structural representation, Description, Recognition, applications, Graph based.

UNIT V: Feature Extraction and Selection

Entropy minimization, Karhunen-Loeve transformation, Feature selection through Functions approximation-Binary feature selection.

UNIT VI: Neural Networks and Kernel Machines

Neural network structures for pattern recognition-Neural network based pattern associators, Self-organizing networks, Support vector machines (SVM),Kernel machines, Maximum margin classification, and generalizability and VC(Vapnik–Chervonenkis) dimension.

Text Books:

1. Pattern Classification and Scene Analysis, Duda R.O. and Hart.P.E., 2001 , second edition, Wiley.
2. Pattern Recognition: Statistical, Structural and Neural Approaches, Robert J.Schalkoff, 2007, JohnWiley & Sons Inc., New York.
3. The Elements of Statistical Learning, Trevor H, Robert T,Jerome Friedman, 2017 , Springer Series.

Reference Books:

1. Pattern Recognition Principles, Tou and Gonzales, 1974, Wesley Publication Company, London.
2. Pattern Recognition Engineering, Morton Nadier and Eric Smith P., 1993, John Wiley & Sons, NewYork.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM702P	Pattern Recognition Lab	0	0	2	1	25	25	50	--

Course Objective
The lab course will enable the students to understand the fundamentals of pattern recognition and to analyze the syntactic, statistical and artificial neural network-based approaches in pattern recognition.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply:** Apply statistical pattern recognition approaches.
CO2	**Create:** Create different approaches of syntactic pattern recognition.
CO3	**Create:** Develop artificial neural network-based pattern recognition system

A minimum of eight practicals to be performed based on the theory course cloud computing [PECAM702T]

Suggested References:

1. Pattern Recognition: Statistical, Structural and Neural Approaches, Robbert Schalkoff, 2018, Wiley Publication.
2. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, John wiley
3. Pattern Recognition Principles, Tou and Gonzales, 1974, Wesley Publication Company, London.
4. Pattern Recognition Engineering, Morton Nadier and Eric Smith P., 1993, John Wiley & Sons, NewYork.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM703T	Cloud Computing	3	0	0	3	40	60	100	3

Course Objective
To impart adequate knowledge of cloud computing, the evolution of the paradigm, its applicability, current and future challenges, cloud computing services and cloud software deployment considerations.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Interpret the concepts of cloud computing to deploy various applications on cloud.
CO2	**Analyze:** Analyze the role of computer network in cloud computing and the concept of virtualization with its advantages and pitfalls.
CO3	**Apply:** Apply appropriate security techniques to provide security for applications on cloud.
CO4	**Create:** Design application using virtualization for deployment of cloud application.
CO5	**Evaluate:** Evaluate the performance of cloud computing services.

SYLLABUS

UNIT I: Introduction to Cloud Computing
Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages of Cloud Computing, Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing. Legal issues when using cloud models, challenges in cloud computing, Overview of Mobile Cloud.

UNIT II: Cloud Computing Architecture
Cloud Computing Architecture, 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).

UNIT III: Virtualization Technology
Virtualization Technology, Deep Understanding of Virtualization Internals, How & why virtualization in cloud computing, Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization, Infrastructure as a Service (Iaas) using OpenStack/OwnCloud.

UNIT IV: Security in Cloud

Security in Cloud, Cloud Security Challenges, Infrastructure Security, Network level security, Host level security, application-level security, data privacy, data security, application security, virtual machine security, Identity Access Management, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

UNIT V: Creating Cloud Application using Azure

Creating Cloud Application using Azure, Creating simple cloud application, configuring an application, creating virtual machine, deployment of application to Windows Azure Cloud, using Azure Storage Services, using Azure Table Service, deployment of application to the production environment.

UNIT VI: Cloud Technologies and Advancements Hadoop

Cloud Technologies and Advancements Hadoop, Map Reduce, Virtual Box, Google App Engine, Programming Environment for Google App Engine, Open Stack, Federation in the cloud, Four levels of Federation, Federated Services and Applications, Future of Federation.

Text Books:

1. Cloud Computing Engine, Mark Cohen and K. Hurley, 2011, O'Reilly Media.
2. Cloud Computing Using Windows Azure for Beginners, B. M. Harwani, 2014, Arizona Business Alliance Publication.
3. Cloud Computing, A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, 2014, Universities Press.

Reference Books:

1. Distributed and Cloud Computing from Parallel Processing to the Internet of Things, Kai Hwang, Geoffrey Fox, Jack Dongarra, 2012, Morgan Kaugmann Publishers.
2. Cloud Computing: Implementation, Management and Security, Ritting house, John W., and James F. Ransome , 2017, CRC Press.
3. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, 2013, Tata McGraw Hill.
4. Cloud Computing- A Practical Approach, Toby Velte, Anthony Velte, Robert Elsenpeter, 2009, Tata McGraw Hill.
5. Cloud Application Architectures: Building Applications and Infrastructure in the cloud: Transactional systems for EC2 and Beyond, George Reese, 2009, O'Reilly.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM703P	Cloud Computing Lab	0	0	2	1	25	25	50	--

Course Objective
The course enables the students to create robust applications using cloud computing with virtualization to improve employability and technical skills.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply:** Build cloud computing applications to solve complex problems.
CO2	**Apply:** Make use of cloud services to develop cloud applications.
CO3	**Create:** Develop cloud computing concepts using virtualizations for logic building activities.

A minimum of eight practicals to be performed based on the theory course cloud computing [PECAM703T]

Suggested References:

1. Cloud Computing Engine, Mark Cohen and K. Hurley, 2011, O'Reilly Media.
2. Cloud Computing Using Windows Azure for Beginners, B. M. Harwani, 2014, Arizona Business Alliance Publication.
3. Cloud Computing, A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, 2014, Universities Press.
4. Kai Hwang, Geoffrey Fox, Jack Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", 2012, Morgan Kaugmann Publishers.
5. Ritting house, John W., and James F. Ransome – Cloud Computing: Implementation, Management and Security, 2017, CRC Press.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM704T	NLP for Indian Languages	3	0	0	3	40	60	100	3

Course Objective
The course provides students with a comprehensive overview of fundamental concepts, models and techniques of Natural Language Processing (NLP), recognize the various applications that increase their technical skills.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	**Understand:** Summarize the basic terminologies and approaches for generation of text and understand the role of machine learning in NLP.
CO2	**Understand:** Outline suitable language models for generation of natural language and techniques for information extraction.
CO3	**Apply:** Apply current methods and statistical approaches to machine translation and NLP applications.
CO4	**Evaluate:** Evaluate the systems useful for language processing, semantic, syntactic analysis and related tasks involved in text processing.
CO5	**Analyze:** Examine the significant techniques for sentiment analysis, recommendation system, opinion mining, audio and speech processing.

SYLLABUS
UNIT I: Introduction and Basic Introduction of Natural Language Processing, NLP tasks in Syntax, Semantics, and Pragmatics, Regular Expressions, Words, Corpora, Text Normalization, Ambiguity Problem, Introduction to Machine Learning for NLP.
UNIT II: Language Models N-gram Language Models, Role of Language Models, Simple N-gram Models, Smoothing, Evaluating Language Models, Part of Speech Tagging, Hidden Markov Models, Maximum Entropy Models.
UNIT III: Syntactic Parsing Parsing, Grammar Formalisms and Tree Banks, Efficient Parsing for Context-Free Grammars (CFGs), Statistical Parsing and Probabilistic CFGs (PCFGs).

UNIT IV: Semantic Analysis Lexical Semantics with WordNet, Lexical Semantics and Word-Sense Disambiguation, Compositional Semantics, Semantic Role Labeling and Semantic Parsing.
UNIT V: Information Extraction (IE) Information Extraction, Named Entity Recognition and Relation Extraction, Text Summarization, Text Classification, IE using Sequence Labeling, Automatic Summarization.
UNIT VI: Machine Translation and NLP Applications Machine Translation (MT): Basic issues in MT, Statistical translation, word alignment NLP Applications: Sentiment Analysis, Opinion Mining, Recommendation System.

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Dan Jurafsky, James Martin, 2008, Pearson Publication.
2. Foundations of Statistical Natural Language Processing, Chris Manning and Hinrich Schuitz, 1st Edition, 1999, The MIT Press.
3. Natural Language Processing Recipes: Unlocking Text Data with Machine Learning and Deep Learning using Python. Akshay Kulkarni, Adarsha Shivananda, Apress, 2019

Reference Books:

1. Natural Language Understanding, Allen James, 2nd Edition, 1994, Pearson.
2. Foundations of Statistical Natural Language Processing, Manning, Christopher and Heinrich, Schutze, 1st Edition, 1999, MIT Press.
3. Statistical Language Learning (Language, Speech, and Communication), Charniack Eugene, 1st Edition, 1996, MIT Press.
4. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, Edward Loper, 1st Edition, 2009, O'Reilly.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM704P	NLP for Indian Languages Lab	0	0	2	1	25	25	50	--

Course Objective
The course enables students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic processing and understand the concepts of morphology, shallow parsing of the language.

Course Outcomes	
After successful completion of this lab course the student will be able to:	
CO1	**Apply:** Make use of suitable language models for generation of natural language and techniques for information extraction.
CO2	**Apply:** Apply various techniques of Sentence Framing, Part-of-Speech (POS) tagging, lexical syntax, text classification for natural language.
CO3	**Analyze:** Examine the significant techniques for sentiment analysis, recommendation system, opinion mining, and other NLP applications.
CO4	**Create:** Develop the systems useful for language processing, semantic, syntactic analysis and related tasks involved in text processing.

A minimum of eight practicals to be performed based on the theory course NLP for Indian Languages [PECAM704T].

Suggested References:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Dan Jurafsky, James Martin, 2008, Pearson Publication.
2. Foundations of Statistical Natural Language Processing, Chris Manning and Hinrich Schuitz, 1st Edition, 1999, The MIT Press.
3. Natural Language Understanding, Allen James, 2nd Edition, 1994, Pearson.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM705T	Information Retrieval	3	0	0	3	40	60	100	3

Course Objective
The course enables the students to understand, design, and implement systems that effectively retrieve relevant information from large collections of data.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Interpret the importance and challenges of information retrieval in various domains.
CO2	**Apply:** Identify different indexing techniques, such as inverted index and n-gram indexing.
CO3	**Apply:** Apply the concept of Query expansion techniques, Retrieval Models, Retrieval Evaluation and Relevance Feedback, XML Retrieval to solve given problem.
CO4	**Analyze:** Analyze basic concepts of XML, challenges specific to XML retrieval and effectiveness of different algorithms.
CO5	**Create:** Develop a new approach for sentiment analysis on social media data and an advanced text mining algorithm for a specific application domain.

SYLLABUS

UNIT I: Introduction to Information Retrieval
Basic concepts and terminologies in information retrieval, History and evolution of information retrieval systems, Components of an information retrieval system, Evaluation metrics in information retrieval, Challenges and current trends in information retrieval.

UNIT II: Document Representation and Indexing
Document Preprocessing and tokenization, Inverted index and term-document matrix, Techniques for handling different types of data (text, images, audio), Weighting schemes and ranking models, Index compression techniques

UNIT III: Query Processing and Retrieval Models
Query understanding and expansion techniques, Boolean retrieval model, Vector space model, Probabilistic retrieval models, learning to rank algorithms.

UNIT IV: Retrieval Evaluation and Relevance Feedback
Evaluation methodologies (precision, recall, F-measure), Test collections and relevance judgments, Relevance feedback and query expansion techniques, User-centered evaluation and user feedback analysis, Cross-Language retrieval and multilingual information retrieval.

UNIT V: XML retrieval
Basic XML concepts, Challenges in XML retrieval, A vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval.

UNIT VI: Advanced Topics in Information Retrieval
Web search and link analysis, social media retrieval and analysis, Recommender systems, Information extraction and text mining.

Text Books:

1. Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schiitze, 2008, Cambridge University Press.
2. Modern Information Retrieval: The Concepts and Technology behind Search, Ricardo Baeza-Yates and Berthier Ribeiro-Neto, 2010, Addison-Wesley Professional.
3. Information Retrieval: A Survey, Ed Greengrass, 2000, University of Maryland.

Reference Books:

1. Information Retrieval: Algorithms and Heuristics, David A. Grossman and Ophir Frieder, 2004, Springer Publications.
2. Information Retrieval: A Survey, Ed Greengrass, 2000, University of Maryland.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM705P	Information Retrieval Lab	0	0	2	1	25	25	50	--

Course Objective
To gain a deep understanding of the fundamental concepts, principles, and models in information retrieval.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply:** Build practical applications developed in Information Retrieval to solve complex problems.
CO2	**Apply:** Make use of different Information Retrieval Techniques.
CO3	**Create:** Build basic Information Retrieval System.

A minimum of eight practicals to be performed based on the theory course Information Retrieval [PECAM705T]

Suggested References:

1. Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schiitze, 2008, Cambridge University Press.
2. Modern Information Retrieval: The Concepts and Technology behind Search, Ricardo Baeza-Yates and Berthier Ribeiro-Neto, 2010, Addison-Wesley Professional.
3. Information Retrieval: A Survey, Ed Greengrass, 2000, University of Maryland.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM706T	IoT & Security	3	0	0	3	40	60	100	3

Course Objective
To study the network of physical objects- 'things'- that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand**: Illustrate the various concepts, terminologies and architecture of IoT systems.
CO2	**Apply:** Apply various communication protocols and technologies used in IoT deployments.
CO3	**Analyze:** Analyze the results of security assessments to improve overall security posture.
CO4	**Evaluate:** Measure the privacy implications of collecting and processing data through IoT devices.

SYLLABUS

UNIT-I: IoT Web Technology the Internet of Things Today
Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT related Standardization, Recommendations on Research Topics.

UNIT II: IoT Applications for Value Creations Introduction
IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT application and value for industry, Home Management eHealth.

UNIT III: Internet of Things Privacy
Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

UNIT IV: Software Security
Defining a discipline, A Risk Management Framework, Code review with a tool, Architectural risk analysis, Software penetrating testing, Risk Based security Testing, An Enterprise S/W security program, Security knowledge

UNIT V: Intrusion Detection
Defining Intrusion Detection, Security concepts intrusion Detection concept, determining strategies for Intrusion Detection, Responses, Vulnerability Analysis, Credentialed approaches, technical issues.

UNIT VI: Biometric Security
Biometric Fundamentals, Types of Biometrics, Fingerprints and Hand Geometry, Facial and Voice Recognition, Iris and Retina scanning, Signature Recognition and Keystroke Dynamics, Behavioral and Esoteric Biometric Technologies, Issues Involving Biometrics, Privacy, Policy and Legal Concerns Raised by Biometrics.

Text Books:

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Fries, 2013, River Publishers.
2. Identity Management for Internet of Thing, Dr. Parikshit Mahalle, Poonam Railkar, 2015, River Publishers.

Reference Books:

1. Getting Started with the Internet of Things, Cuno Pfister, 2011, O'Reily Media.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM706P	IoT & Security Lab	0	0	2	1	25	25	50	--

Course Objective
The lab course provides hands-on experience and practical skills of IoT & Security.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand**: Illustrate the various concepts, terminologies and architecture of IoT systems.
CO2	**Apply:** Apply various communication protocols and technologies used in IoT deployments.
CO3	**Analyze:** Analyze the results of security assessments to improve overall security posture.

A minimum of eight practicals to be performed based on the theory course IoT & Security [PECAM706T]

Suggested References:

1. Identity Management for Internet of Thing, Dr. Parikshit Mahalle, Poonam Railkar, 2015, River Publishers.
2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Fries, 2013, River Publishers.
3. Getting Started with the Internet of Things, Cuno Pfister, 2011, O'Reily Media.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM707T	AI in Gaming	3	0	0	3	40	60	100	3

Course Objective
The course enables the students to understand the fundamentals of Intelligent behavior and decision making in games and apply the relevant algorithms in path finding strategies and design games using artificial intelligence techniques based on the genre.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Relate the importance of artificial intelligence in games.
CO2	**Apply:** Apply the different steering behaviors in movement of characters.
CO3	**Apply:** Choose the Path finding techniques for designing games.
CO4	**Analyze:** Examine the decision-making methods for game.
CO5	**Create:** Design the strategies for game using game theory.

SYLLABUS

UNIT-I: Introduction
Model of Game AI, Algorithms Data Structures and Representations, Game AI: -The kind of AI in Games, Speed and Memory, AI Engine.

UNIT-II: Basics of Movement Algorithms
Basics of Movement Algorithms, Kinematic Movement Algorithm, Steering behaviors, Combining Steering Behaviors, Jumping, Coordinated Movements.

UNIT-III: Path finding and decision making
Pathfinding Graph, Dijkstra, A*, Hierarchical Pathfinding, Continuous Time Pathfinding, Movement Planning, Decision trees, Goal oriented behavior, Rule based System.

UNIT-IV: Strategies Board games
Game Theory, Minimaxing, Transposition Tables and Memory, Memory Enhanced Test Algorithms, Turn based Strategy games.

UNIT-V: Supporting
Scheduling, Anytime Algorithms, Level of Detail, Communication, Getting Knowledge Efficiently, Event Managers, Polling Stations, Sense Management.

UNIT-VI: Designing Game AI

The Design, Shooters, Driving, Real Time strategy, Sports, Turn Based strategy Games, Teaching Characters, Flocking and Herding games.

Text Books:

1. Artificial Intelligence for Games, Ian Millington, John Funge, Second edition, Morgan Kaufmann Publishers, 2012, CRC Press.
2. Artificial Intelligence- A Modern Approach, Second Edition, Stuart Jonathan Russell, Peter Norvig Russell, 2010, Prentice Hall.
3. Artificial Intelligence, Elaine Rich, Kevin knight, 2004, Tata McGraw-Hill.

Reference Books:

1. Introduction to AI and Expert systems, Dan W Patterson, 2001, Prentice Hall.
2. Programming Game AI by Example, Mat Buckland, (Wordware Game Developers Library)

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM707P	AI in Gaming Lab	0	0	2	1	25	25	50	--

Course Objective
The lab course provides the knowledge to design games using artificial intelligence techniques based on the genre.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply:** Apply machine learning techniques to gaming scenarios.
CO2	**Analyze:** Analyze and discuss specific applications of AI in the gaming industry.
CO3	**Create:** Develop skills in coding AI functionalities related to character behavior, pathfinding, and decision-making and create adaptive and responsive AI behaviors that enhance the overall gaming experience.

A minimum of eight practicals to be performed based on the theory course AI in Gaming [PECAM707T]

Suggested References:

1. Artificial Intelligence for Games, Ian Millington, John Funge, Second edition, Morgan Kaufmann Publishers, 2012, CRC Press.
2. Artificial Intelligence- A Modern Approach, Second Edition, Stuart Jonathan Russell, Peter Norvig Russell, 2010, Prentice Hall.
3. Artificial Intelligence, Elaine Rich, Kevin knight, 2004, Tata McGraw-Hill.
4. Introduction to AI and Expert systems, Dan W Patterson, 2001, Prentice Hall.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM708T	Text Processing	3	0	0	3	40	60	100	3

Course Objective
The course aims to provide students with a comprehensive understanding of the fundamental concepts and techniques of text processing.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Interpret the basic concepts of text processing, including tokenization, stemming, and part-of-speech tagging.
CO2	**Analyze:** Analyze and preprocess text data using various techniques such as regular expressions, stop-word removal, and normalization.
CO3	**Apply:** Apply text processing techniques to solve real-world problems such as sentiment analysis, topic modeling, and text classification.
CO4	**Create**: Develop and Implement text processing algorithms using programming languages.
CO5	**Evaluate:** Evaluate the performance of text processing algorithms using appropriate metrics.

SYLLABUS

UNIT-I: Introduction to Text Processing
The fundamental concepts of text processing, tokenization, stemming, and part-of-speech tagging. preprocess text data using various techniques such as regular expressions, stop-word removal, and normalization.

UNIT-II: Text Classification
Text classification, feature extraction, model selection, and evaluation. Sentiment analysis and topic modeling- Latent Dirichlet Allocation, Posterior Inference for LDA, Dynamic Topic Models and Correlated Topic Models

UNIT-III: Text Classification and Information retrieval
Information retrieval, indexing, retrieval models, Standard Evaluation Measures, Standard Retrieval Models and Filtering Approaches, Collaborative Adaptive Filtering, Novelty and Redundancy Detection and evaluation metrics.

UNIT-IV: Natural Language Processing
Introduction Basics of natural language processing, history of NLP, Text Analytics and NLP, Various Steps in NLP including parsing, named entity recognition, and semantic analysis.

UNIT-V: Deep Learning for Text Processing
Basics of deep learning for text processing, including neural networks, word embeddings, and sequence models. Deep Learning is Large Neural Networks, Deep Learning is Hierarchical Feature Learning

UNIT-VI: Advanced Topics in Text Processing
Advanced topics in text processing, text summarization, text generation, and machine learning interpretability, importance of Interpretability, Taxonomy of Interpretability Methods etc

Text Books:

1. Natural Language Processing with Python by Steven Bird, Ewan Klein, and Edward Loper, 2009, O'Reilly Media.
2. Speech and Language Processing by Daniel Jurafsky and James H. Martin, 2019, Pearson Education
3. Text Mining: Classification, Clustering, and Applications by Ashok Srivastava, Mehran Sahami, and Text Mining Team, 2009, Chapman and Hall/CRC

Reference Books:

1. Text Processing in Python by David Mertz, 2003, Addison-Wesley Professional.
2. Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schütze, 1999, MIT Press
3. Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data by Dipanjan Sarkar, 2016, Apress
4. Python Text Processing with NLTK 2.0 Cookbook by Jacob Perkins, 2010, Packt Publishing
5. Speech and Language Processing by Daniel Jurafsky and James H. Martin, 2019, Pearson Education.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM708P	Text Processing Lab	0	0	2	1	25	25	50	--

Course Objective
The course provides opportunities to develop hands-on experience in applying the concepts and techniques learned in the Text Processing course to real-world problems

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply:** Apply text processing techniques to solve real-world problems such as sentiment analysis, topic modeling, and text classification.
CO2	**Apply:** Develop hands-on experience in applying the concepts and techniques learned in the Text Processing course to real-world problems
CO3	**Create:** Develop real world applications using neural networks, word embedding, and sequence models to solve given use cases.
CO4	**Evaluate:** Evaluate the performance of text processing algorithms using appropriate metrics.

A minimum of eight practicals to be performed based on the theory course Text Processing [PECAM708T]

Suggested References:

1. Text Processing in Java by Mitzi Morris, 2005, Addison-Wesley Professional.
2. Text Processing in Python by David Mertz, 2003, Addison-Wesley Professional.
3. Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data by Dipanjan Sarkar, 2016, Apress.
4. Text Processing in Python by David Mertz, 2003, Addison-Wesley Professional.
5. Text Analytics Made Accessible by Gaurav Vohra, 2018, Apress.
6. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython by Wes McKinney, 2017, O'Reilly Media.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM709T	Time Series Analysis	3	0	0	3	40	60	100	3

Course Objectives
The course aims to provide students with a combine description of data, facilitate interpretation of data, and forecast future values of the time series variable.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Understand:** Interpret the results of time series analysis, such as autocorrelation, partial autocorrelation, and spectral density.
CO2	**Apply:** Apply time series models to real-world data to make accurate predictions and forecasts.
CO3	**Analyze:** Analyze the performance of time series models using diagnostic checks, such as residual analysis and goodness-of-fit tests.
CO4	**Evaluate:** Evaluate the effectiveness of time series models based on their predictive accuracy and interpretability.
CO5	**Create:** Formulate new time series models that improve upon existing models by incorporating additional features or techniques.

SYLLABUS

UNIT-I: Stochastic process and its main characteristics

Stochastic process. Time series as a discrete stochastic process. Stationarity. Main characteristics of stochastic processes (means, auto-covariation and autocorrelation functions).
Stationary stochastic processes. Stationarity as the main characteristic of stochastic component of time series.

UNIT-II: Autoregressive-moving average models ARMA (p,q)

Moving average models MA(q). Condition of invertibility. Autoregressive models AR(p). Yull-Worker equations. Stationarity conditions. Autoregressive-moving average models ARMA (p,q).

UNIT-III: Coefficient estimation in ARMA (p,q) processes. Box-Jenkins' approach

Coefficient's estimation in autoregressive models. Coefficient estimation in ARMA (p) processes. Quality of adjustment of time series models. AIC information criterion. BIC information criterion.

UNIT-IV: The unit root problem

The unit root problem. Spurious trends and regressions. Unit root tests (Dickey-Fuller). ADF test and the choice of the number of lags. Other unit root tests.

UNIT-V: Vector auto-regression model and co-integration

Time series co-integration. Co-integration regression. Testing of co-integration. Vector Auto-regression and co-integration. Co-integration and error correction model.

UNIT-VI: Causality in time series

Granger causality. Hypothesis testing on rational expectations. Hypothesis testing on market efficiency.

Text Books:

1. Introduction to Time Series Analysis and Forecasting, Douglas C. Montgomery, Cheryl L. Jennings, and Murat Kulahci, 2015, Wiley Series.
2. Time Series Analysis and Its Applications: With R Examples, Robert H. Shumway and David S. Stoffer, 2017, Springer in Statistics.
3. Applied Time Series Analysis for Managerial Forecasting by John E. Hanke and Dean W. Wichern. , 2004 Prentice Hall.
4. Time Series Analysis: Forecasting and Control by George E. P. Box, Gwilym M. Jenkins, and Gregory C. Reinsel. 2015, Wiley Series.
5. Time Series: Theory and Methods by Peter J. Brockwell and Richard A. Davis, 2016, Springer Texts in Statistics.

Reference Books:

1. Time Series Analysis and Its Applications: With R Examples by Robert H. Shumway and David S. Stoffer, 2017, Springer.
2. Time Series Analysis: Forecasting and Control by George E. P. Box, Gwilym M. Jenkins, and Gregory C. Reinsel, 2015, Wiley.
3. Introduction to Time Series and Forecasting by Peter J. Brockwell and Richard A. Davis,2016 , Springer

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM709P	Time Series Analysis Lab	0	0	2	1	25	25	50	--

Course Objective

The course enables the students to create robust applications using Time series analysis.

Course Outcomes

After successful completion of this course, the students will be able to:

CO1	**Apply:** Apply time series analysis techniques to visualize and interpret patterns in time-ordered data
CO2	**Analyze:** Analyze the residuals of a time series model to check for model adequacy.
CO3	**Apply:** Select time series models to forecast future values of a time series
CO4	**Evaluate:** Evaluate the performance of a time series model using appropriate metrics.

A minimum of eight practicals to be performed based on the theory course Time Series Analysis [PECAM709T]

Suggested References:

1. Introduction to Time Series Analysis and Forecasting, Douglas C. Montgomery, Cheryl L. Jennings, and Murat Kulahci, 2015,Wiley Series.
2. Time Series Analysis and Its Applications: With R Examples, Robert H. Shumway and David S. Stoffer,2017 , Springer in Statistics.
3. Applied Time Series Analysis for Managerial Forecasting by John E. Hanke and Dean W. Wichern. ,2004 Prentice Hall.
4. Time Series Analysis: Forecasting and Control by George E. P. Box, Gwilym M. Jenkins, and Gregory C. Reinsel. 2015, Wiley Series.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM710T	AI for Robotics	3	0	0	3	40	60	100	3

Course Objectives

To give exposure of the fundamentals of AI and expert systems and its application in Robotics and to familiarize the students with the Fundamental concept of AI and expert system.

Course Outcomes

After successful completion of this course the students will be able to:

CO1	**Understand:** Understand the fundamental concepts of robotics by integrating artificial intelligence methodologies.
CO2	**Analyze:** Analyze foundational knowledge of robotics using AI tools.
CO3	**Apply:** Apply techniques for robot path planning and navigation using AI methods. Know about the differential motion add statistics in robotics using AI.
CO4	**Create:** Develop a comprehensive understanding of the foundational concepts and principles underlying robotics.

SYLLABUS

UNIT-I: Introduction

Introduction: History, Definition of AI, Emulation of human cognitive process, Intelligent agents:The concept of rationality, the nature of environments, the structure of agents.

UNIT-II: Search Methods

Problem Solving Agents: Problem Definitions, Formulating Problems, Searching for solutions: Measuring Problem, Solving Performance with examples. Search Strategies: Uninformed search strategies, Breadth first Search, Uniform Cost Search, depth first search, depth limited search, Iterative deepening depth first search, bidirectional search, comparing uniformed search strategies. Informed search strategies: Heuristic information, Hill climbing methods, best first search, branch and bound search, optimal search and A* and Iterative deepening A*.

UNIT-III: Programming And Logics In Artificial Intelligence

LISP and other programming languages: Introduction to LISP, Syntax and numerical function, LISP and PROLOG distinction, input, output and local variables, interaction and recursion, property list and arrays alternative languages, formalized symbolic logics, properties of WERS, non-deductive inference methods.

UNIT-IV: Introduction to Robotics

Fundamentals of Robotics, Robot Kinematics: Position Analysis, Dynamic Analysis and Forces, Robot

Programming languages & systems: Introduction, the three levels of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

UNIT-V: Expert System

Expert system : Introduction, difference between expert system and conventional programs, basic activities of expert system: Interpretation, Prediction, Diagnosis, Design, Planning, Monitoring, Debugging, Repair, Instruction, Control. Basic aspects of expert system: Acquisition module, Knowledge base Production rules, semantic net, frames, Inference engine: Backward chaining and forward chaining. Explanatory interface.

UNIT-VI: Exploring Sensing Technologies in Robotics

Characteristics of sensing devices, Criterion for selections of sensors, Classification, & applications of sensors. Internal sensors: Position sensors, & Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors.

Text Books:

1. Artificial Intelligence Modern Approach, ARussell Stuart, Norvig Peter, 2010, Pearson Education series in AI, 3rd Edition.
2. Introduction to Artificial Intelligence and Expert Systems, Dan.W.Patterson, 2009, PHI Learning.
3. A guide to Expert Systems, Donald.A.Waterman, 2002, Pearson.
4. Artificial intelligence, E. Rich and K. Knight, 1992, TMH, 2nd edition.

Reference Books:

1. Introduction to AI and Expert Systems, D.W. Patterson, 1992, PHI.
2. Introduction to Expert Systems, Peter Jackson, 1992, AWP, M.A.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM710P	AI for Robotics Lab	0	0	2	1	25	25	50	--

Course Objectives
The course enables students with hands-on experience and practical skills in implementing artificial intelligence techniques in the field of robotics.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Apply:** Develop proficiency in programming languages commonly used in robotics
CO2	**Understand:** Demonstrate the ability to integrate various sensors into robotic systems.
CO3	**Analyze:** Analyze complex robot kinematic and dynamic scenarios into individual components
CO4	**Evaluate:** Evaluate the performance in terms of path quality, computational resources, and adaptability to dynamic environments.

A minimum of eight practicals to be performed based on the theory course AI for Robotics [PECAM710T]

Suggested References:

1. Artificial Intelligence Modern Approach, ARussell Stuart, Norvig Peter, 2010, Pearson Education series in AI, 3rd Edition.
2. Introduction to Artificial Intelligence and Expert Systems, Dan.W.Patterson, 2009, PHI Learning.
3. A guide to Expert Systems, Donald.A.Waterman, 2002, Pearson.
4. Artificial intelligence, E. Rich and K. Knight, 1992, TMH, 2nd edition.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM711T	CNN for Visual Recognition	3	0	0	3	40	60	100	3

Course Objective
Develop a deep understanding of the foundational concepts of CNNs, including convolutional layers, pooling, activation functions, and the architecture of these neural networks tailored for visual data.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Illustrate CNN architectures, convolutional layers, pooling, activation functions, and the mechanisms behind their effectiveness in processing visual data.
CO2	**Analyze:** Analyze the skills in image preprocessing, normalization, augmentation, and transformation techniques essential for preparing data to be fed into CNNs effectively.
CO3	**Apply:** Develop Framework to understand how CNNs extract hierarchical features from images and learn representations useful for various visual recognition tasks.
CO4	**Evaluate:** Evaluate and select appropriate CNN architectures based on specific requirements, understanding the trade-offs and applicability of different models like VGGNet, ResNet, Inception, etc.
CO5	**Apply:** Apply transfer learning by utilizing pre-trained CNN models and fine-tuning them for specific tasks, reducing computational resources and training time.

SYLLABUS
UNIT I: Introduction to Cloud Computing Introduction to CNNs for Visual Recognition. Computer Vision overview; historical context; course logistics, Image Classification, The data-driven approach: k-nearest neighbor, Linear Classification I.
UNIT II: Fundamental of Linear classification Loss Functions, Linear Classification II, higher-level representations, image features Optimization, stochastic gradient descent.
UNIT III: Neural Networks and Backpropagation Neural Networks and Backpropagation, backpropagation: multi-layer perceptrons, the neural viewpoint, Convolutional Neural Networks, history, convolution and pooling, convnets outside vision.

UNIT IV: Deep Learning Tools Deep Learning Hardware and Software, CPUs, GPUs, TPUs, PyTorch, TensorFlow, dynamic vs static computation graphs Training Neural Networks, Activation functions, data processing, batch normalization, transfer learning.
UNIT V: CNN Architectures CNN Architectures AlexNet, VGG, GoogLeNet, ResNet, etc. Recurrent Neural Networks RNN, LSTM, language modeling, image captioning, vision + language, attention.
UNIT VI: Generative Models Generative Models PixelRNN/PixelCNN, variational auto-encoders, generative adversarial networks Detection and Segmentation semantic segmentation, object detection; instance segmentation.

Text Books:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 2023, Publisher: Alanna Maldonado.
2. Deep Learning for Computer Vision, Rajalingappaa Shanmugamani, 2022, Kindle Edition.

Reference Books:

1. Guide to Convolutional Neural Networks- A Practical Application to Traffic-Sign Detection and Classification , Hamed Habibi Aghdam, Elnaz Jahani Heravi , 2017.
2. A Guide to Convolutional Neural Networks for Computer Vision By Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, Gerard Medioni, Sven Dickinson, 2018.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM711P	CNN for Visual Recognition Lab	0	0	2	1	25	25	50	--

Course Objective
To develop a solid understanding of the foundational concepts of CNNs, including convolutional layers, pooling, activation functions, and the architecture of these neural networks tailored for visual data.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Illustrate the CNN architectures, convolutional layers, pooling, activation functions, and the mechanisms behind their effectiveness in processing visual data.
CO2	**Analyze:** Analyze the skills in image preprocessing, normalization, augmentation, and transformation techniques essential for preparing data to be fed into CNNs effectively.
CO3	**Apply:** Develop Framework to understand how CNNs extract hierarchical features from images and learn representations useful for various visual recognition tasks.

A minimum of eight practicals to be performed based on the theory course CNN for Visual Recognition [PECAM711T]

Suggested References:
1. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 2023, Publisher: Alanna Maldonado. 2. Deep Learning for Computer Vision, Rajalingappaa Shanmugamani, 2022, Kindle Edition.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM712T	Robotics - Algorithms & Control	3	0	0	3	40	60	100	3

Course Objectives
Develop a comprehensive understanding of robotic systems, including manipulators, mobile robots, kinematics, dynamics, sensors, and actuators.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Understand:** Illustrate the foundational concepts of artificial intelligence, including machine learning, natural language processing, and computer vision.
CO2	**Apply:** Apply acquired knowledge and skills in a comprehensive capstone project, demonstrating the ability to address real-world path planning challenges.
CO3	**Analyze:** Analyze the algorithmic complexity of various motion planning methods and evaluate their efficiency in different robotic scenarios.
CO4	**Evaluate:** Evaluate skills in evaluating the performance of SLAM algorithms, considering metrics such as accuracy, precision, and computational efficiency.
CO5	**Create:** Design and implement a robotic system that incorporates a variety of sensors, emphasizing practical applications.

SYLLABUS
UNIT-I: Fundamentals of AI & Robotics Fundamentals of AI & Robotics, Overview: foundations, scope, problems, and approaches of AI. Intelligent agents: reactive, deliberative, goal driven, utility-driven, and learning agents, Artificial Intelligence programming techniques, Bug algorithms and its variations.
UNIT-II: Advanced Topics in Robot Motion Planning Geometric Roadmaps, Visibility Graphs, and Algorithmic Complexity, Pursuit Evasion and Probabilistic Roadmaps.
UNIT-III: Path Planning Path Planning Algorithms: Robot embodiment, Dijkstra's algorithm, A*, Sample based path planning, Path Smoothing.

UNIT-IV: Exploring Sensing Technologies in Robotics

Characteristics of sensing devices, Criterion for selections of sensors, Classification, & applications of sensors. Internal sensors: Position sensors, & Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors.

UNIT-V: Simultaneous Localization and Mapping (SLAM)

Localization, Simultaneous Localization and Mapping (SLAM), Advanced Topics in Robotics: Distributed Robotics, Autonomous Robotics, Multi-agent.

UNIT-VI: The Sparse Extended Information Filter

The SEIF SLAM Algorithm, Mathematical Derivation, Sparsification, Incremental Data Association, Tree Based Data Association.

Text Books:

1. Introduction to Autonomous Robots, Nikolaus Correll and Roland Siegwart, 2022, MIT Press.
2. Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Peter Corke, 2017, Springer International Publishing AG.

Reference Books:

1. Feedback Control of Dynamic Systems, Gene F. Franklin, J. Da Powell and Abbas Emami-Naeini, 2022, Pearson Education.
2. Probabilistic Robotics, Sebastian Thrun, Wolfram Burgard and Dieter Fox, 2005, MIT Press.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECAM712P	Robotics - Algorithms & Control Lab	0	0	2	1	25	25	50	--

Course Objectives
To provide students with hands-on experience in implementing algorithms and control strategies for robotic systems.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Understand:** Demonstrate proficiency in implementing algorithms for various robotic tasks, such as path planning, obstacle avoidance, and localization.
CO2	**Apply:** Develop and implement trajectory planning algorithms for robotic manipulators or mobile robots.
CO3	**Analyze:** Analyze the algorithmic complexity of various motion planning methods and evaluate their efficiency in different robotic scenarios.
CO4	**Evaluate:** Develop skills in evaluating the performance of SLAM algorithms, considering metrics such as accuracy, precision, and computational efficiency.

A minimum of eight practicals to be performed based on the theory course Robotics - Algorithms & Control [PECAM712T]

Suggested References:

1. Introduction to Autonomous Robots, Nikolaus Correll and Roland Siegwart, 2022, MIT Press.
2. Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Peter Corke, 2017, Springer International Publishing AG.
3. Feedback Control of Dynamic Systems, Gene F. Franklin, J. Da Powell and Abbas Emami-Naeini, 2022, Pearson Education.
4. Probabilistic Robotics, Sebastian Thrun, Wolfram Burgard and Dieter Fox, 2005, MIT Press.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
OECAM701T	CRM Technologies - Salesforce	3	0	0	3	40	60	100	3

Course Objective
To understand the Salesforce administration & development and perform a variety of analytics on different data sets that enhances employability and entrepreneurship skills.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Illustrate the concept of configuring and managing Salesforce orgs.
CO2	**Apply**: Develop expertise in configuring complex Salesforce features.
CO3	**Analyze**: Examine the Salesforce security features and compliance standards.
CO4	**Create:** Adapt a solid understanding of Salesforce development tools.
CO5	**Evaluate:** Evaluate the customization of Salesforce and addressing specific business requirements.

SYLLABUS

UNIT-I: Salesforce Administration
Introduction to Salesforce: Cloud Computing, Services of Cloud computing, Types of Cloud, What is Salesforce, Salesforce Products, How to create Salesforce developer edition account, Walkthrough Salesforce.com platform.

UNIT-II: Configuration and Customization
Salesforce: Data types, field types and components. Apps in Salesforce (Standard Apps, Custom Apps), Steps to create a SalesforceApp, Salesforce tabs, Types of Tab Visibility, Users & User Licenses. Salesforce Objects, fields & Field Dependency, Profiles & Roles.

UNIT-III: Relationships & WorkFlow
Relationships in Salesforce, Validation Rule & formula, Approval Process, Flows and Process Builder, Page Layouts. WorkFlow: Define Workflow, Workflow Rules, Components of Workflow (action, criteria), How to configure Workflow Rule Criteria? Setup workflow tasks & Email Alers & Field Update, Time dependent workflows.

UNIT-IV: Authorization & Sharing Data
Profiles, Permission Sets, Org-Wide Defaults, Role hierarchies, Sharing Rules, Manual Sharing, Record Types Data Management: Import and Export Data, Data Loader, Reports and Dashboards.

UNIT-V: Introduction to Apex:
Collections (List, Map, Set), DML Operation, SOQL And SOSL Controllers in APEX Apex Triggers: Overview on Triggers, Trigger Events: Before Triggers, After Triggers, Insert Triggers, Update Triggers, Delete Triggers, Undelete Triggers, Trigger context variables, Recursive Triggers, Governor Limits.

UNIT-VI: Asynchronous Apex:
Future Method, Queueable Apex, Scheduled Apex Batch Apex: Iterable Class, QueryLocator, GetQueryLocator, Start Method, Execute Method, Finish Method, Batchable Context. Text Class: StartTest, StopTest, Test Class on Apex class and Triggers.

Text Books:

1. Salesforce Platform App Builder Certification Handbook, Siddhesh Kabe and Muhammad Ehsan Khan, 2018, Packt Publication.
2. Salesforce CRM: The Definitive Admin Handbook, Paul Goodey, 2020, Packt Publication.

Reference Books:

1. Salesforce Essentials for Administrators, Mohith Shrivastava, 2018, Packt Publication.
2. Learning Salesforce Lightning Application Development, Mohith Shrivastava, 2020, Packt Publication.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PROJAM702	Project-I	0	0	8	4	75	75	150	--

Course Objective
The objective of this course is to equip students with necessary tools and techniques to identify, analyze and propose solutions to real life problems that benefit the wider community.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	**Apply:** Identify and propose solutions to complex engineering problems of industry and society.
CO2	**Evaluate:** Critically evaluate alternate assumptions, approaches, procedures and tradeoffs to solve engineering problems.
CO3	**Apply:** Apply engineering knowledge for design and development of systems in an ethical and eco-friendly manner as an individual and as a member or leader in diverse team to manage project in multidisciplinary domain.
CO4	**Analyze:** Analyze the system and communicate the inferences with engineers and the community at large in written & oral forms.
CO5	**Create:** Innovate, design & develop systems to address real life problems and engage in life- long learning in continuing professional development.

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S. B. JAIN INSTITUTE OF TECHNOLOGY, MANAGEMENT
& RESEARCH, NAGPUR.
(An Autonomous Institute, Affiliated to RTMNU, Nagpur)
DEPARTMENT OF EMERGING TECHNOLOGIES (AI&ML and AI&DS)

COURSE SYLLABUS

FOR

SEMESTER – VIII

B. Tech.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(W. E. F. 2024-25)

Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PROJAM801	Project-II	0	0	12	6	75	75	150	--

Course Objective
The objective of this course is to equip students with necessary tools and techniques to identify, analyze and propose solutions to real life problems that benefit the wider community.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	**Apply:** Identify and propose solutions to complex engineering problems of industry and society.
CO2	**Evaluate:** Critically evaluate alternate assumptions, approaches, procedures and tradeoffs to solve engineering problems.
CO3	**Apply:** Apply engineering knowledge for design and development of systems in an ethical and eco-friendly manner as an individual and as a member or leader in diverse team to manage project in multidisciplinary domain.
CO4	**Analyze:** Analyze the system and communicate the inferences with engineers and the community at large in written & oral forms.
CO5	**Create:** Innovate, design & develop systems to address real life problems and engage in life- long learning in continuing professional development.

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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PROJAM801	Industry Internship	0	0	12	6	75	75	150	--

Course Objective
This course is envisioned to provide with a valuable opportunity for gaining real-world experience and skills to get ready for employment.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	**Apply:** Develop a professional network, recognize potential career opportunities and ethical practices within the industry.
CO2	**Analyze:** Analyze industry trends and identify potential areas for growth and improvement as an individual and as a member or leader in diverse team to manage project in multidisciplinary domain.
CO3	**Apply:** Apply the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
CO4	**Create:** Apply industry specific knowledge and skills to develop ecofriendly solutions for industrial & societal problems and communicate the inferences with professional presentations and reports.
CO5	**Analyze:** Analyze the functioning of internship organization and recommend changes for improvement in processes.

13/1/24
Dr. H.R. Tuteja

Dr. R. Jain
13/1/24

S.A. Tumke
13/1/24

A. Chauhan
13.01.24

Dr. S.S. Badhoja
13/01/24

13/01/2024
Dr. M S Nimbarte

13/1/24

Dr. V.P. Balpande

Revision	BOS Meeting	Date	W. E. F
--	5th	13-01-2024	2024-25