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 DATA SCIENCE

(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.)
PECAD701T	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.

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.)
PECAD701P	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 [PECAD701T]

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.)
PECAD702T	Applications of 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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--	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.)
PECAD702P	Applications of IoT & Security Lab	0	0	2	1	25	25	50	--

Course Objective
The lab course is crucial for providing 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 Applications of IoT & Security [PECAD702T]

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.)
PECAD703T	Data Science for NLP	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). Also helps to 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 classify texts using deep learning techniques.
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 & Syntactic Parsing N-gram Language Models, Simple N-gram Models, Estimating Parameters and Smoothing, Part of Speech Tagging, Hidden Markov Models, Parsing, Grammar Formalisms and Tree Banks
UNIT III: Semantic Analysis Lexical Semantics with WordNet, Lexical Semantics and Word-Sense Disambiguation, Compositional Semantics, Semantic Role Labeling and Semantic Parsing.

UNIT IV: Information Extraction (IE)
Information Extraction, Named Entity Recognition and Relation Extraction, Text Summarization, Text Classification, IE using Sequence Labeling, Automatic Summarization, Subjectivity and Sentiment Analysis.

UNIT V: Deep Learning for NLP
Introduction to Deep Learning, Deep Learning NLP Techniques: Convolutional Neural Networks, Recurrent Neural Networks, Autoencoders, Transformer, Classifying Text with Deep Learning

UNIT VI: NLP Applications
NLP Applications: Sentiment Analysis, Opinion Mining, Audio and Speech Processing, 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. Natural Language Processing Recipes: Unlocking Text Data with Machine Learning and Deep Learning using Python. Akshay Kulkarni, Adarsha Shivananda, 2019, Apress

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.)
PECAD703P	Data Science for NLP 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 applications 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 Data Science for NLP [PECAD703T].

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.)
PECAD704T	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.)
PECAD704P	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 [PECAD704T]

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.)
PECAD705T	Bitcoins and Cryptocurrencies	3	0	0	3	40	60	100	3

Course Objective
To understand the underlying principles of Cryptocurrencies, including Blockchain technology, decentralized networks, cryptographic principles, and their significance in the financial landscape.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Illustrate the term blockchain within the context of cryptocurrencies.
CO2	**Understand:** Illustrate the ability to remember and articulate the definitions of crucial terms related to cryptocurrencies.
CO3	**Evaluate:** Evaluate the impact of consensus mechanisms on the security of the Ethereum network.
CO4	**Create:** Develop proficiency in cryptocurrency trading, investment strategies, and risk management.
CO5	**Analyze:** Analyze the potential benefits and challenges of integrating blockchain into existing financial infrastructures.

SYLLABUS
UNIT I: Blockchain Introduction to Blockchain, Generations of Blockchain, Structure of Blockchain, Opportunities and challenges in Blockchain.
UNIT II: Design Primitives Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature, Hash chain to Blockchain, Bitcoin Basic, Basic consensus mechanisms
UNIT III: Consensus Protocol Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols, distributed consensus, consensus in Bitcoin. Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains.
UNIT IV: Ethereum The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.
UNIT V: Use case 1 Blockchain in Financial Software and Systems (FSS), Settlements, KYC, Capital markets, Insurance.

UNIT VI: Use case 2

Blockchain for Government: Digital identity, land records and other kinds of record keeping between government entities, Public distribution system social welfare systems, Blockchain Cryptography, Privacy and Security on Blockchain.

Text Books:

1. Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained, Imran Bashir, 2nd Edition, March 2018, Packt Publishing Ltd.
2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, 2016, Princeton University Press.
3. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, 2017 (Second Edition), O'Reilly Media.

Reference Books:

1. Digital Gold: Bitcoin and the Inside Story of the Misfits and Millionaires Trying to Reinvent Money, Nathaniel Popper, 2015, HarperCollins.
2. Blockchain Applications: A Hands-On Approach, Arshdeep Bahga and Vijay Madisetti, 2019, VPT.
3. The Bitcoin Standard: The Decentralized Alternative to Central Banking, Saifedean Ammous, 2018, Wiley.

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.)
PECAD705P	Bitcoins and Cryptocurrencies 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	**Understand:** Illustrate the term blockchain within the context of cryptocurrencies.
CO2	**Apply:** Apply an extensive comprehension of smart contracts and decentralized applications.
CO3	**Evaluate:** Evaluate the key features of Bitcoin, culminating in the creation of a clear presentation that highlights its decentralized nature.

A minimum of eight practicals to be performed based on the theory course Bitcoins and Cryptocurrencies [PECAD705T]

Suggested References:

1. Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained, Imran Bashir, 2nd Edition, March 2018, Packt Publishing Ltd.
2. Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, 2016, Princeton University Press.
3. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, 2017 (Second Edition), 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.)
PECAD706T	Data Science for Healthcare	3	0	0	3	40	60	100	3

Course Objective
Students will be able to understand what the healthcare industry is and its role in society and develop a solid foundation in the core concepts of data science in terms of healthcare.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply:** Model the raw healthcare data into valuable knowledge and actionable insights.
CO2	**Analyze**: Discover about Industry 4.0 and the industry 4.0 Environment
CO3	**Analyze:** Analyze the Health Information Systems and Technologies (e.g., social and mobile health technologies, architectures, networks, internet, cloud)
CO4	**Create:** Design SQL queries to answer questions in healthcare.
CO5	**Evaluate**: Evaluate and interpret machine learning models for healthcare applications, including disease prediction and patient risk assessment.

SYLLABUS

UNIT I: Introduction of Data science in Health care
Introduction to Health Data Science, Theory of Healthcare System, Healthcare provider Payment systems, Theory of claims data, Introduction to Electronic Health record, Higher level categorization, Modern Information Engineering.

UNIT II: Data Preprocessing for data science in Health care
Extract, Transform, Load (ETL)from the data ware housing SQL, Absolute and relative comparisons, Process Mining with Health care and its tools, Proxy diagnosis and cohort analysis, predicting consumption events, Using Large Language model to analyse data, Value based healthcare and health outcome indicators.

UNIT III: Healthcare in the Industry 4.0
Introduction to healthcare industry, Key insights of the Healthcare Industry, Challenges of Healthcare industry: Healthcare delivery models, Introduction to the Opportunities in Healthcare, Impact of industry 4.0 on the Healthcare Industry, Real world outlook on the Healthcare Industry.

UNIT IV: Tableau for Healthcare
Introduction to Tableau and Healthcare Data, 5 Ws of developing Dashboards for healthcare, Data Preparation and Cleaning in Tableau, Advanced Data Visualization of Healthcare data in Tableau, Integrating Tableau with Healthcare Databases, Ethics and Security in Tableau for Healthcare, Any Use case.

UNIT V: SQL for Healthcare
Getting started with SQL, Overview of Sample Database, Creating and inserting data into Tables, Joining Tables, Healthcare SQL Use Cases and basics: Volumes, Patients, Emergency Room Throughput, Cost of Care, Procedures, Blood Pressure Management, Real world Practice using Healthcare Data.

UNIT VI: Machine Learning for Healthcare
Introduction to machine learning algorithms and their applications in healthcare. Supervised and unsupervised learning for healthcare analytics. Building predictive models for disease diagnosis and patient outcomes. Predictive Modeling and Risk Stratification: advanced techniques for predictive modeling in healthcare. Risk stratification and personalized medicine using machine learning.

Text Books:

1. Data science in healthcare: Benefits, challenges and opportunities, Abedjan, Ziawasch and Boujemaa, Nozha and Campbell, Stuart and Casla, Patricia and Chatterjea, Supriyo and Consoli, Sergio and Costa-Soria, Cristobal and Czech, Paul and Despenic, Marija and Garattini, Chiara and others, 2019, Springer.
2. Advances in Data Science: Methodologies and Applications, Phillips-Wren, Gloria and Esposito, Anna and Jain, Lakhmi C, 2021, Springer.
3. Big Data and Artificial Intelligence for Healthcare Applications, Saxena, Ankur and Brault, Nicolas and Rashid, Shazia, 2021, CRC Press.
4. Healthcare data analytics, Reddy, Chandan K and Aggarwal, Charu C, 2015, CRC Press.

Reference Books:

1. R programming for data science, Peng, Roger D, 2016, Lean pub Victoria, BC, Canada.
2. Data-driven healthcare: how analytics and BI are transforming the industry, Madsen, Laura B, 2014, John Wiley \& Sons.
3. Healthcare analytics: from data to knowledge to healthcare improvement, Yang, Hui and Lee, Eva K, 2016, John Wiley \& Sons.

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.)
PECAD706P	Data Science for Healthcare Lab	0	0	2	1	25	25	50	--

Course Objective
Students will be able to understand the core concepts of data science, including data exploration, cleaning, and preprocessing in terms of healthcare.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply**: Utilize statistical and visual methods to understand the characteristics of healthcare datasets.
CO2	**Evaluate:** Evaluate and fine-tune models for accuracy and interpretability.
CO3	**Analyze:** Analyze temporal trends and patterns in healthcare data.
CO4	**Create**: Develop dynamic and interactive dashboards using visualization tools like Tableau or Matplotlib.

A minimum of eight practicals to be performed based on the theory course Data Science for Healthcare [PECAD706T]

Suggested Reference:

1. R programming for data science, Peng, Roger D, 2016, Lean pub Victoria, BC, Canada.
2. Data-driven healthcare: how analytics and BI are transforming the industry, Madsen, Laura B, 2014, John Wiley \& Sons.
3. Healthcare analytics: from data to knowledge to healthcare improvement, Yang, Hui and Lee, Eva K, 2016, John Wiley \& Sons.

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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.)
PECAD707T	CNN for Visual Recognition	3	0	0	3	40	60	100	3

Course Objective
To 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 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.
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, Computer vision overview; historical context, course logistics, Image Classification, The data-driven approach; k-nearest neighbor, linear classification.
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.

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.)
PECAD707P	CNN for Visual Recognition Lab	0	0	2	1	25	25	50	--

Course Objective
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 [PECAD707T]

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.)
PECAD708T	Digital Forensic	3	0	0	3	40	60	100	3

Course Objective
The course enables the students to learn concepts of cybercrime and digital forensics to determine various digital operandi.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	**Understand:** Interpret the concept of Forensic science and Digital Forensic concepts in the real world.
CO2	**Apply:** Apply the cyber pieces of evidence, the Digital forensic process model, their legal perspective, and the digital evidence used to commit cyber offenses.
CO3	**Analyze:** Analyze the various digital forensic operandi and motives behind cyber-attacks and their processes.
CO4	**Analyze:** Inspect and collect digital evidence to process crime at incident scenes by working with Windows and DOS systems.
CO5	**Evaluate:** Determine the concept of various forensic tools to investigate cybercrime.

SYLLABUS

UNIT I: Cyber Crime and Computer Crime
Introduction to Digital Forensics, Definition and types of Cybercrimes, Use of Computer Forensics in Law Enforcement, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics.

UNIT II: Computer Forensic Evidence and Capture:
Data Recovery Defined, Data Back-up and Recovery, The Role of Back-up in Data Recovery, The Data - Recovery Solution. Evidence Collection and Data Seizure: why collect evidence? Collection options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collections, Art Facts, Collection Steps, Controlling contamination.

UNIT III: Duplication and Preservation of Digital Evidence:
Preserving the Digital Crime Scene, Computer Evidence Processing steps, Legal Aspects of collecting and Preserving Computer forensic evidence. Computer image verification and authentication: Special needs of Evidential Authentication, Practical Consideration, Practical Implementation. .

UNIT IV: Computer forensic analysis and validation:
Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, and performing remote acquisitions. Network Forensics: Network Forensic overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project.

UNIT V: Processing crime at incident scenes:
Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT VI: Working with Windows and DOS systems:
Understanding file systems, exploring Microsoft file structures examining NTFS disks, understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, and virtual machines.

Text Books:

1. Computer Forensics, Computer Crime Scene Investigation, John R. Vacca, 1st Edition, 2009, Laxmi Publications Pvt Limited.
2. Guide to Computer Forensics and Investigations, Bill Nelson, Amelia Phillips, Christopher Steuart, 5th Edition, 2018, Cengage Learning.
3. The basics of digital Forensics, The primer for getting started in digital forensics, John Sammons, 5th Edition, 2014, Elsevier Science.

Reference Books:

1. Computer Forensics for Dummies, Carol Pollard, Reynaldo Anzaldua, 3rd Edition, 2008, Wiley.
2. Computer Forensics and Cyber Crime: An Introduction, Marjie Britz, 2nd Edition, 2008, Pearson Prentice Hall.
3. Forensic Science, Crime Scene Analysis, David Elio Malocco, MR David Elio Malocco, 2nd Edition, 2015, CreateSpace Independent Publishing Platform.

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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.)
PECAD708P	Digital Forensic Lab	0	0	2	1	25	25	50	--

Course Objective

The course enables the students to learn the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of computer forensics that enhance employability and entrepreneurship skills.

Course Outcomes

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

CO1	**Apply:** Identify and apply sound forensic practices and forensic tools to investigate cybercrime.
CO2	**Analyze:** Inspect the different obfuscation and counter-forensic techniques in the cybercrime scene.
CO3	**Apply:** Apply in-depth insight into retention characteristics of storage systems for desktop, mobile, and non-standard computing systems.
CO4	**Analyze:** Analyze and Preserve the integrity of seized digital evidence and digital pieces of evidence.

A minimum of eight practicals to be performed based on the theory course of course Digital Forensic [PECAD708T]

Suggested References:

1. Computer Forensics for Dummies, Carol Pollard, Reynaldo Anzaldua, 3rd Edition, 2008, Wiley.
2. Computer Forensics, Computer Crime Scene Investigation, John R. Vacca, 1st Edition, 2009, Laxmi Publications Pvt Limited.
3. Forensic Science, Crime Scene Analysis, David Elio Malocco, MR David Elio Malocco, 2nd Edition, 2015, CreateSpace Independent Publishing Platform.

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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.)
PECAD709T	Dockers and Kubernets	3	0	0	3	40	60	100	3

Course Objective

The course enables the students to comprehend the core concepts of Dockers and Kubernets, including Pods, Services, Deployments, and Replica Sets.

Course Outcomes

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

CO1	**Understand:** Interpret the concepts of containerization and clarify how Docker streamlines the creation, deployment, and management of containers.
CO2	**Apply:** Apply proficient skills to deploy applications within Docker containers and effectively manage the lifecycle of containers.
CO3	**Create:** Develop optimized container images by utilizing Docker files and proficiently manage these images through Docker registries.
CO4	**Analyze:** Analyze various Kubernets concepts, including Pods, Services, Deployments, and Replica Sets, within real-world scenarios.
CO5	**Evaluate:** Evaluate the scalability and performance of applications deployed on a Kubernets cluster.

SYLLABUS

UNIT I: Dockers & Containers Introduction
Dockers & Containers Evolution, Differences between VM's and Containers, Use Cases of Docker, Benefits of using Containers in Docker, Working with Docker Commands.

UNIT II: Docker Images, Volumes & Networking
Docker Images & Layers, Docker Container Layers, working with Docker Images, Building own Images using Docker file, Working with Docker Volumes & Networking.

UNIT III: Registries in Docker
Overview of Registries in Docker- Public and Private, Deep Dive into Docker Hub, Other Public and Private Registries, Overview of Docker Compose, Docker Defining and running multi-container applications, Overview Docker Swarm, Build your own Docker Swarm Cluster, Filtering and Scheduling Containers.

UNIT IV: Kubernets Introduction

Kubernets Evolution, what is Kubernets, Use Cases of Kubernets Differences between Kubernets and Docker Swarm.

UNIT V: Kubernets Architecture

Kubernets Master Introduction, Components of Kubernets Master Node Components Introduction.

UNIT VI: Kubernets Cluster - Deploying applications

Pods Introduction, Lifecycle of Pods, Working with Pods to manage multiple containers, Deploying Pods via Replication Controllers, Testing resiliency.

Text Books:

1. The Kubernets Book, Nigel Poulton's, Second Edition, 2022, Packt Publishing.
2. Kubernets: Up and Running, Joe Beda, Kelsey Hightower, Brendan Burns, 2017, O'Reilly Media.
3. Docker Deep Dive, Nigel Poulton, 2017, Nigel Poulton (self-published).

Reference Books:

1. Docker in Action, Jeff Nickoloff and Stephen Kuenzli, 2016, Manning Publications.
2. Docker: Up & Running" by Karl Matthias, Sean P. Kane, and Jon Pulsifer, 2015, 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.)
PECAD709P	Dockers and Kubernets Lab	0	0	2	1	25	25	50	--

Course Objective
The course enables the students to demonstrate proficiency in Docker commands for building, managing, and running containers and manages containerized applications.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Analyze:** Analyze Docker to create, build, and deploy containerized applications.
CO2	**Create:** Develop applications within Docker containers and adeptly managing the lifecycles of containers to ensure efficient operations.
CO3	**Evaluate:** Evaluate the scalability and resilience of applications in a Kubernets environment.

A minimum of eight practicals to be performed based on the theory course Dockers and Kubernets [PECAD709T]

Suggested References:
1. Docker in Action, Jeff Nickoloff and Stephen Kuenzli, 2016, Manning Publications. 2. Docker: Up & Running" by Karl Matthias, Sean P. Kane, and Jon Pulsifer, 2015, 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.)
PECAD710T	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.)
PECAD710P	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 [PECAD710T]

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.
5. Time Series: Theory and Methods by Peter J. Brockwell and Richard A. Davis, 2016, Springer Texts in Statistics.

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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.)
PECAD711T	Data and Internet Security	3	0	0	3	40	60	100	3

Course Objective
To provide comprehensive understanding of the principles, techniques, and best practices related to securing data and internet-based systems.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Interpret the fundamental security concepts in data and internet security.
CO2	**Apply:** Make a use of security technologies such as antivirus software, intrusion detection systems, and encryption tools to protect against common cyber threats.
CO3	**Analyze:** Inspect the legal and ethical issues related to data and internet security.
CO4	**Evaluate:** Determine the effectiveness in educating users and promoting a security-conscious culture.
CO5	**Create:** Develop the cryptographic algorithms and techniques with their applications in securing data and communication.

SYLLABUS

UNIT-I:
Introduction to Data Security: Overview of information and data security, importance of data security, data and information management technologies.
Cryptographic Techniques - symmetric and asymmetric encryption, hash functions and digital signatures, Public Key Infrastructure (PKI).

UNIT-II:
Network Security: Firewalls and Intrusion Detection Systems (IDS), Virtual Private Networks (VPNs), Wireless Network Security, Security for Internet of Things (IoT), Advanced Persistent Threats (APTs), Insider Threats, Access Control and Authentication, Access Control Models, Biometrics.

UNIT-III:
Database Security Securing Relational and NoSQL Databases, Database Activity Monitoring (DAM) Tools, Database Encryption and Masking, Database Encryption Tools, Data Loss Prevention (DLP),
Web and Application Security, Common Web Application Vulnerabilities, Secure Coding Practices, Application Security Testing, Content Security Policy (CSP).

UNIT-IV:
Information Security Policies, Procedures and Audits: Information Security Policies, Security Policy Implementation, Security Policy Configuration, Security Standards, Guidelines and frameworks, Security Standards Organizations.

UNIT-V: Information security Management & Responsibilities: Accountability - Information Security Roles and Responsibilities, Risk Analysis, Security Metrics, Incident Response, Security visualization.

UNIT-VI:
Emerging Trends and Special Topics: Cloud Security, Internet of Things (IoT) Security, Machine Learning and AI in Security, Blockchain and Cryptocurrencies, Future Trends and Challenges.

Text Books:

1. Advanced Persistent Threat Hacking, Tyler Wrightson, 2014, McGraw-Hill Education.
2. Network Security Essentials: Application and Standards, William Stallings, 6th Edition 2017, Pearson Education.
3. Computer Security: Principles and Practice, Stallings William, 2008, Pearson Education.

Reference Books:

1. Computer and Information Security Handbook, John R. Vacca, 2009, Elsevier Science.
2. Security in Computing, Charles P. Pfleeger, 1997, Prentice Hall PTR.
3. Cryptography and Network Security: Principles and Practice, William Stallings, 2016, Pearson Education.
4. Information Security: Principles and Practice, Mark Stamp, 2005, Wiley.

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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.)
PECAD711P	Data and Internet Security Lab	0	0	2	1	25	25	50	--

Course Objective
To provide comprehensive understanding of the principles, techniques, and best practices related to securing data and internet-based systems.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply:** Make use of data security tools to develop data security applications.
CO2	**Apply:** Construct, configure and manage intrusion detection/prevention systems.
CO3	**Create:** Develop data and internet security concepts using cryptographic techniques.

A minimum of eight practicals to be performed based on the theory course Data and Internet Security [PECAD711T]

Text Books:

1. Advanced Persistent Threat Hacking, Tyler Wrightson, 2014, McGraw-Hill Education
2. Network Security Essentials: Application and Standards, William Stallings, 6th Edition 2017, Pearson Education.
3. Computer Security: Principles and Practice, Stallings William, 2008, Pearson Education

Reference Books:

1. Computer and Information Security Handbook, John R. Vacca, 2009, Elsevier Science
2. Security in Computing, Charles P. Pfleeger, 1997, Prentice Hall PTR
3. Cryptography and Network Security: Principles and Practice, William Stallings, 2016, Pearson Education
4. Information Security: Principles and Practice, Mark Stamp, 2005, Wiley

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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.)
PECAD712T	Computational Neuroscience	3	0	0	3	40	60	100	3

Course Objective
This course will develop theoretical and computational approaches to structural and functional organization in the brain.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand**: Illustrate the fundamental biophysics underlying neural responses.
CO2	**Evaluate:** Evaluate Neural coding and decoding, emphasizing sensory systems
CO3	**Understand**: Illustrate the principles and mechanisms involved in neural coding & populations.
CO4	**Create:** Design Models for adaptation, learning, and memory.
CO5	**Apply**: Build the ability to critically evaluate research findings related to synaptic plasticity and learning.

SYLLABUS
UNIT-I: Single Neurons Introduction of Neurons, Biophysics of spike generation and action potential propagation Neural coding and decoding – models of neural response, spike-triggered characterizations of response.
UNIT-II: Measuring neural information Introduction NeuroVis General Neural Information Visualization Straightforward Interpretation Practical ROS Interface, NeuroVis, Use Cases Adaptation of neural responses, Normative models of function.
UNIT-III: Neural Coding, Simple Linear Regression Introduction of Coding, Neural Coding type Examples of Neural Coding, Information Simple Linear Regression, type Simple Linear Regression, Examples of Regression.
UNIT-IV: Neural Populations Introduction of Neural Populations, Columnar organization Receptive fields, Distributed assemblies Receptive field maps, Parallel Channels, Correlations and interactions, Network structure and computation.
UNIT-V: Higher level functions Introduction Memory: the Hopfield model, Introduction Memory: the Hopfield model Example, Introduction Decision making and Bayesian analysis, Decision making and Bayesian Example.

UNIT-VI: Synaptic plasticity and learning

Introduction Synaptic plasticity and learning, Reinforcement Learning type, Reinforcement Learning example, Representational learning introduction, Representational learning example.

Text Books:

1. Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems, Dayan, Peter, and L. F. Abbott. Cambridge, 2001 MA: MIT Press.
2. Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems, P. Dayan and L.F. Abbott, 2001. MIT Press.
3. Spikes: Exploring the Neural Code, F. Rieke, D. Warland, R. de Ruyter van Steveninck, and W. Bialek, 1997, MIT Press.

Reference Books:

1. Principles of Neural Science, E. Kandel, 2000, McGraw-Hill.
2. Matlab for neuroscientists: An introduction to scientific computing in Matlab, P. Wallisch et al., 2008, Academic Press.
3. The human brain coloring book, M. Diamond and A. Scheibel, 1985, Collins Reference.

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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.)
PECAD712P	Computational Neuroscience Lab	0	0	2	1	25	25	50	--

Course Objective
The laboratory component of a course will develop theoretical and computational approaches to structural and functional organization in the brain.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Apply:** Build computational models to simulate and analyze neural processes
CO2	**Evaluate:** Evaluate the proficiency in programming languages commonly used in computational neuroscience
CO3	**Apply**: Make use of skills in processing and analyzing neural data generated from simulations
CO4	**Create:** Design and implement experiments or simulations that address specific questions in computational neuroscience

A minimum of eight practicals to be performed based on the theory course Computational Neuroscience [PECAD712T]

Suggested References:

1. Principles of Neural Science, E. Kandel, 2000, McGraw-Hill.
2. Matlab for neuroscientists: An introduction to scientific computing in Matlab, P. Wallisch et al., 2008, Academic Press.
3. Spikes: Exploring the Neural Code, F. Rieke, D. Warland, R. de Ruyter van Steveninck, and W. Bialek, 1997, 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.)
OECAD701T	Social Media Analysis	3	0	0	3	40	60	100	3

Course Objective
Equip students with a comprehensive understanding and practical skills in social media analysis.

Course Outcomes	
After successful completion of this course, the students will be able to:	
CO1	**Understand:** Illustrate the fundamental concepts of social media user behavior, networks, and temporal dynamics.
CO2	**Analyze:** Analyze social media content using natural language processing techniques.
CO3	**Understand:** Demonstrate the principles and techniques for processing large datasets efficiently, focusing on Map Reduce.
CO4	**Apply:** Apply matrix factorization techniques to learn, map, and make recommendations based on social media data.
CO5	**Create:** Develop critical thinking skills to interpret and evaluate the outcomes of social media analysis.

SYLLABUS
UNIT I: Introduction to Social Media Users Measuring User Behavior in Wikipedia, Diversity of User Activities, Power Law and Long Tail in Human Activities, Exploring Online Behavior on Twitter, and Summary of User Activities.
UNIT II: Types and Properties of Social Networks Explicit vs. Implicit Networks, Visualizing Networks, Degrees: The Winner Takes All, Correlations, Triangles, Clustering, and Assortativity, Summary of Network Properties.
UNIT III: Temporal Dynamics in social media Traditional Models of Temporal Processes, Bursty Activities and Periodicities, Reservoir Sampling and Forecasting Metrics, Introduction to ARIMA for Time Series, Detecting Trends and Seasonality, Summary of Temporal Processes.
UNIT IV: Analyzing Social Media Content Defining Content: Focus on Text and Unstructured Data, Basics of Natural Language Processing, Identifying Topics from Content Features, Popularity of Topics and User Interests, Introduction to Topic Modeling, Summary of Content Analysis.

UNIT V: Introduction to Map Reduce

Counting Words and Multi-Stage Flows, Large-Scale MapReduce Models, Challenges with Long-Tailed Data, Sampling, Approximations, and Data Structures, Summary of Large Dataset Processing.

UNIT VI: Overview of Social Media Services

Problem Formulation for Analysis, Matrix Factorization and Non-Negative Matrix Factorization, Predictions, Recommendations, and Evaluation, Common Approaches and Issues, Summary of Learning and Recommendation.

Text Books:

1. Social Media Data Mining and Analytics, Gabor Szabo, Gungor Polatkan, Oscar Boykin and Antonios Chalkiopoulos, 2018, Wiley Publishing company.
2. Social Media Mining: An Introduction, Reza Zafarani, Mohammad Ali Abbasi and Huan Liu, 2014, Cambridge University Press.

Reference Books:

1. Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More, Matthew A. Russell, 2018, O'Reilly Media.
2. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, 2014, McGraw-Hill Education.
3. Analyzing Social Media Networks with NodeXL: Insights from a Connected World, 2019, Derek Hansen, Ben Shneiderman and Marc A. Smith.

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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.)
PROJAD702	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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Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PROJAD801	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.

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.)
PROJAD801	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. Lunke
13/1/24

Y. Wankhede
13.01.24

Dr. S.S. Bedekar
13/1/24

13/01/2024
Dr. M.S. Nimbarte

13/1/24

Dr. V.P. Balpande

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