Institute Level- Industrial orientated Open Elective

OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE) AIDSML

Structure

LIST OF OE COURSES OFFERED SEMESTER WISE									
SEMESTER III									
Sr. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Credits**	**ISE**	**ESE**	**Total**
1.	**IOE3315**	Open Elective I-Foundations of AI, Data Science, and Machine Learning	3	--	--	**3**	50	50	**100**
2.	**IOE3316**	Open Elective-01 Lab - Foundations of AI, Data Science, and Machine Learning Lab	--	--	2	**1**	25	25	50
SEMESTER IV									
3.	**IOE3417**	Open Elective II - AI in Practice: Design to Deployment	2	--	--	**2**	50	50	**100**
SEMESTER V									
4.	**IOE3514**	Open Elective III- AI Applications and Emerging Technologies	2	--	--	**2**	50	50	**100**
		TOTAL	**7**	**--**	**2**	**08**	**175**	**175**	**350**

Note * The End Semester Examination (ESE) will be conducted as either theory or oral or presentation

BoS Chairman
Dept. of Electronics and Telecommunication

Institute Level- Industrial orientated Open Elective

OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE) AIDSML

Government College of Engineering, Karad

Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- AIDSML

IOE3315: Open Elective I-Foundations of AI, Data Science, and Machine Learning

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	03		Duration of ESE	As applicable

Prerequisite : Mathematics, Statistics and Programming for problem solving

Course Outcomes: Students will be able to

CO1	Understand the fundamental principles and concepts of Artificial Intelligence (AI) and Data Science.
CO2	Demonstrate a solid understanding of the mathematical foundations essential for AI and Machine Learning (ML).
CO3	Apply Python programming skills to perform data manipulation and analysis.
CO4	Employ techniques fortime series analysis and demonstrate in depth understanding of Machine Learning.

	Course Contents	CO	Hours
Unit 1	**Introduction to AI & Data Science:** Overview of AI and Data Science, The data science workflow, AI applications across various industries, Ethical considerations in AI and data science	CO1	(05)
Unit 2	**Mathematical and Statistical Foundations for AI & ML:** Linear algebra basics: vectors, matrices, and operations, Calculus essentials: derivatives and integrals, Probability and statistics for data science.	CO2	(07)
Unit 3	**Programming Fundamentals for AI & Data Science** Python for data manipulation, Libraries: NumPy and Pandas for data science, Data visualization with Matplotlib and Seaborn, Introduction to Scikit-learn for AI. Introduction to TensorFlow and PyTorch.	CO3	(07)
Unit 4	**Data Preprocessing Techniques and Exploratory Data Analysis (EDA):** Handling Missing Data, Data Cleaning and Noise Removal, Data Transformation, Encoding and Feature Engineering, Data exploration and visualization techniques	CO3	(06)
Unit 5	**Time Series Analysis and Data Science Life Cycle:** Time series components (trend, seasonality, noise), Moving averages, smoothing techniques, autocorrelation. Data Science Life Cycle and Overview of MLOps.	CO4	(07)
Unit 6	**Fundamentals of Machine Learning:** Overview and implementation basics of various machine learning. Supervised Learning: Definition, examples, and algorithms; linear regression, decision trees, SVM. Unsupervised Learning: Definition, examples, and algorithms k-means clustering, hierarchical clustering, PCA.	CO4	(07)

Text Books

1.	Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python" O'Reilly Media, 2017.
2.	Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani - "Introduction to Statistical Learning: with Applications in R" Springer 2017.
3	Sanjeev J. Wagh , Manisha S. Bhende, Anuradha D. Thakare "Fundamentals of Data Science, Tayler & Fransic CRC press 2021.
4	Alan Beaulieu - "Learning SQL: Generate, Manipulate, and Retrieve Data" - O'Reilly Media 2009.

Reference Books

1.	Joel Grus - "Data Science from Scratch: First Principles with Python" - O'Reilly Media 2015.
2.	Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media 2019.

Useful Links

1.	https://onlinecourses.nptel.ac.in/noc21_cs69/preview
2.	https://onlinecourses.nptel.ac.in/noc22_cs32/preview
3.	https://nptel.ac.in/courses/106106226/

*Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.

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Department of Information Technolog
Govt. College of Engineering, KARAD

Government College of Engineering, Karad				
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective-AIDSML				
IOE3316: Open Elective-01 Lab - Foundations of AI, Data Science, and Machine Learning Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		ISE	25
Total Credits	01		ESE	25
Prerequisite: Mathematics, Statistics and Programming for problem solving				
Course Outcomes (CO): Students will be able to				

CO1	Understand the fundamental principles of data science, AI applications, and Python scripting.
CO2	Apply Python programming skills to perform data manipulation, analysis, and visualization
CO3	Demonstrate proficiency in linear algebraic computations and exploratory data Analysis
CO4	Utilize advanced data preprocessing techniques and Time Series Analysis

Course Contents		CO
Implementation of following concepts		
Experiment 1	**Data Science Workflow:** Implement a basic data science workflow using a sample dataset.	**CO1**
Experiment 2	**AI Applications**: Case study analysis of AI applications in healthcare, finance, and retail.	**CO1**
Experiment 3	**Python Basics**: Write Python scripts for basic data operations (CRUD - Create, Read, Update, Delete).	**CO2**
Experiment 4	**NumPy:** Perform array operations and linear algebraic computations using NumPy.	**CO2**
Experiment 5	**Pandas:** Data manipulation and analysis using Pandas (e.g., merging, grouping, and aggregating data).	**CO2**
Experiment 6	**Matplotlib and Seaborn**: Create various types of plots (line, bar, scatter) using Matplotlib and Seaborn.	**CO2**
Experiment 7	**Handling Missing Values**: Techniques to handle missing data (e.g., imputation, deletion).	**CO3**
Experiment 8	**Linear Algebra**: Implement matrix operations, eigenvalues, and eigenvectors using Python.	**CO3**
Experiment 9	**End to End Data Wrangling**: Scaling, Feature Engineering, Outlier Handing etc.	**CO4**
Experiment 10	**Exploratory Data Analysis (EDA):** Perform EDA on a dataset to summarize its main characteristics.	**CO4**
Experiment 11	**Visualization:** Create histograms, box plots, and pair plots to visualize data distributions.	**CO4**
Experiment 12	**Forecasting using basic Time Series Analysis**	**CO4**
List of Submission:		
	Minimum number of Experiments: 10	

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Second Year (Sem – IV) OE- Institute Level- Industrial orientated Open Elective- AIDSML				
IOE3417: Open Elective II - AI in Practice: Design to Deployment				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite : Foundations of AI, Data Science, and Machine Learning

Course Outcomes (CO): Students will be able to

CO1	Implement supervised and unsupervised algorithms using Scikit-learn.
CO2	Enhance model performance through feature engineering and model selection.
CO3	Develop and apply CNNs and RNNs for deep learning and NLP tasks.
CO4	Utilize advanced data mining techniques for analytics and Neural Networks for Computer Vision.

	Course Contents	CO	Hours
Unit 1	**Supervised Machine Learning with Python:** Introduction to Scikit-learn library,Implementing Supervised Learning Algorithms: Implementation of algorithms like linear regression, logistic regression, decision trees, and SVM using Scikit-learn,	**CO1**	**(04)**
Unit 2	**Unsupervised Machine Learning with Python:** Implementing Unsupervised Learning Algorithms: Implementation of algorithms like k-means clustering, hierarchical clustering using Scikit-learn.	**CO1**	**(05)**
Unit 3	**Feature Engineering & Model Selection:** Feature Extraction: Techniques for extracting features from raw data,Feature Transformation: Techniques for transforming features to improve model performance., Model Selection: Strategies for selecting the best model, cross-validation, and hyperparameter tuning.	**CO2**	**(05)**
Unit 4	**Deep Learning Fundamentals:** Basics of neural networks, activation functions, and architectures., Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs): Structure, applications, and implementation basics	**CO3**	**(06)**
Unit 5	**Natural Language Processing (NLP):** Text processing: tokenization, stemming, lemmatization, stop-word removal, vectorization methods and word embeddings, sentiment analysis.	**CO3**	**(04)**
Unit 6	**Computer Vision and Advanced Data Mining Techniques:** Computer Vision Fundamentals: Image processing techniques, object detection, and recognition,	**CO4**	**(03)**

Text Books

1.	Ethem Alpaydin - "Introduction to Machine Learning" - MIT Press (2020)
2.	Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media (2019)
3.	Richard Szeliski - "Computer Vision: Algorithms and Applications" - Springer (2010)

Reference Books

1.	Jiawei Han, Micheline Kamber, and Jian Pei - "Data Mining: Concepts and Techniques" - Morgan Kaufmann (2011)
2.	Alice Zheng and Amanda Casari - "Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists" - O'Reilly Media (2018)
3.	S. J. Wagh , Manisha S. Bhende, Anuradha D. Thakare "Fundamentals of Data Science, Tayler & Fransic CRC press 2021

Useful Links

1.	https://nptel.ac.in/courses/106102220/
2.	https://nptel.ac.in/courses/106106145/
3.	https://nptel.ac.in/courses/106106212/
4.	https://nptel.ac.in/courses/106105152/

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Government College of Engineering, Karad				
Third Year (Sem – V) OE- Institute Level- Industrial orientated Open Elective- AIDSML				
IOE3514: Open Elective III- AI Applications and Emerging Technologies				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite: Advanced AI Integration

Course Outcomes (CO): Students will be able to

CO1	Utilize GANs for generating creative content and explore advanced techniques like conditional GANs.
CO2	Utilize vector databases for semantic retrieval and Analyze and use Large Language Models (LLMs) for various generative tasks
CO3	Design RAG systems to enhance LLM output with external knowledge and Apply prompt engineering techniques for task-specific responses
CO4	Implement reinforcement learning algorithms and apply them in autonomous systems.
CO5	Deploy AI on edge devices and integrate with IoT for applications in smart cities, industry, and healthcare.

	Course Contents	CO	Hours
Unit 1	**Generative Adversarial Networks (GANs) and Creative AI:** Understanding the concept of GANs and their architecture, Applications of GANs in generating realistic images, videos, and creative content, Exploring conditional GANs and style transfer techniques, Case studies in art, design, and content creation.	**CO1**	**(04)**
Unit 2	**Introduction to Generative AI:** Fundamentals of Generative AI, Vector Databases, Large Language Models (LLM), Key use cases: content generation, code assistance, image synthesis	**CO2**	**(04)**
Unit 3	**Generative AI:** Retrieval-Augmented Generation (RAG), Prompt Engineering, Fine-Tuning of LLMs, LoRA (Low-Rank Adaptation), PEFT (Parameter-Efficient Fine-Tuning). Hugging Face Transformers. Real-world applications: chatbots, search assistants, enterprise AI	**CO3**	**(05)**
Unit 4	**Reinforcement Learning and Autonomous Systems:** Introduction to reinforcement learning principles, Applications of reinforcement learning in autonomous systems, Deep dive into algorithms such as Q-learning and deep Q-networks, Case studies on robotics, gaming, and control systems.	**CO4**	**(04)**
Unit 5	**Edge AI and Internet of Things (IoT) Integration:** Deploying AI algorithms on edge devices for real-time processing, Integration of AI with IoT ecosystems for smart applications, Use cases in smart cities, industrial IoT, and healthcare monitoring, Challenges and opportunities in edge AI and IoT convergence.	**CO4**	**(05)**
Unit 6	**AI for Healthcare and Biomedical Applications:** Role of AI in medical imaging analysis and diagnosis, AI-driven drug discovery and personalized medicine, Patient care management using AI-based solutions, Ethical considerations and regulatory challenges in AI-driven healthcare.	**CO5**	**(04)**

Text Books

1.	David Foster - "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" - O'Reilly Media (2019)
2.	Maxim Lapan - "Deep Reinforcement Learning Hands-On" - Packt Publishing (2018)
3.	Bharat S. Chaudhari, Sheetal N. Ghorpade, Marco Zennaro, "TinyML for Edge Intelligence in IoT and LPWAN Networks", Elsevier, Academic Press (2024).
4.	Perry Lea ,IoT and Edge Computing for Architects - Second Edition Paperback – Import, 6 March 2020

Reference Books

1.	Peter Wittek - "Quantum Machine Learning: What Quantum Computing Means to Data Mining" - Academic Press (2016)
2.	S. Kevin Zhou, Hayit Greenspan, Dinggang Shen - "Deep Learning for Medical Image Analysis" - Academic Press (2017)
3.	Pete Warden and Daniel Situnayake - "TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers" - O'Reilly Media (2020)

Useful Links

1.	https://nptel.ac.in/courses/106106139/
2.	https://nptel.ac.in/courses/106105215/

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