**Artificial Intelligence**

**(In partnership with Google)**

**COURSE OBJECTIVE**

* Comprehensive understanding of Artificial Intelligence: Learn about AI's capabilities and its significance in modern business operations.
* Python Programming and Data Science: Gain hands-on experience with Python and its packages for data science, covering basic and advanced concepts.
* Deep Learning, Transfer Learning and Natural Language Processing: Master various deep learning and transfer learning models, applying them to industry-specific use-cases and learning how to evaluate, improve, and tune them.
* Computer Vision and its Applications: Acquire knowledge of computer vision, including image preprocessing, augmentation, segmentation, and feature extraction.
* Hands-on Object Detection: Learn about object detection algorithms and get practical experience in implementing them.

**COURSE PREREQUISITES:**

* Basic knowledge of programming concepts and experience with a programming language such as Python.
* Familiarity with data analysis and data manipulation techniques.
* Understanding of statistical concepts and techniques.
* Knowledge of artificial intelligence (AI) concepts and its applications in various domains.

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| **UNIT-I** | **Introduction to Artificial Intelligence & Introduction to Python 10 Hours** |
| Prelude - Why AI? - What is AI? - AI in Practice - AI in Business - AI Platforms - Conclusion – Self Assessment- What is Data Science? - Why Python? - Python Basics- Python Packages: Numpy, Pandas, Matplotlib and seaborn | |
| **UNIT-II** | **Working with AI: Deep Learning 20 Hours** |
| Prelude - What is Deep Learning? - Deep Learning - Evolution and Business Potential - Introduction to Neural Networks-How do Neural Networks work -How do Neural Networks learn- Gradient Descent & its types- Backpropagation - Introduction to the Sequential Mode:Activation functions, Layers, Training, Loss function - Building ANN Using Tensorflow - Evaluating Improving and Tuning ANN - Convolutional Neural Networks - Introduction to Convolutional Neural Networks - What are convolutional neural networks? - Building, Evaluating, Improving, and Tuning the CNN- Introduction to Recurrent Neural Networks - The idea behind Recurrent Neural Networks - The Vanishing Gradient Problem - LSTM -Building, Evaluating, Improving, and Tuning the RNN and LSTM | |
| **UNIT-III** | **Transfer learning Models and NLP 10 Hours** |
| Prelude - Introduction to Transfer Learning Models - How does Transfer Learning Works? -When should we use Transfer Learning? -Approaches to transfer Learning -Inception V3 - Xception - Resnet-50 - VGG16 & VGG-19 - Hands on with Inception V3  -Introduction to NLTK - Bag of Words model - Natural Language Processing in Python - Sentiment analysis using Natural Language Processing | |
| **UNIT-IV** | **Computer Vision & Object Detection 14 Hours** |
| Prelude - Why Computer Vision? - What is Computer Vision? - Concepts and Techniques in Computer Vision - Computer Vision Tools and Platforms – Process in Computer Vision - Operations on Image - Image Analysis using OpenCV - Video Analysis using OpenCV - Introduction to Object Detection - Traditional techniques of Object Detection - Introduction to YOLO - How YOLO Works - Different Version Of YOLO - YOLO Architecture | |
| **UNIT-V** | **Deploying the AI model 6 Hours** |
| Prelude - Introduction to different modes of Deployments - Working with Flask framework - Flask Operations - Hands On With Basic of Flask - Integrating Deep learning model with Web Application | |

**Total : 60 Periods**

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| **COURSE OUTCOMES**  On completion of the course, students will be able to: | |
| CO1 : | Demonstrate a fundamental understanding of the history and foundations of artificial intelligence (AI) and its key principles and theories. |
| CO2 : | Apply basic principles of AI to develop solutions for problem-solving, inference, perception, knowledge representation, and learning tasks. |
| CO3 : | Build multiple deep learning models to address real-world problems, demonstrating proficiency in applying AI techniques. |
| CO4 : | Utilize data visualization techniques effectively, understanding the importance of design and visual components in communicating AI-related insights. |
| CO5: | Develop a fully-fledged web application with AI capabilities, showcasing practical implementation skills in integrating AI into software solutions. |
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| **REFERENCES** | |
| 1 | https://www.tensorflow.org/tutorials |
| 2 | https://www.tensorflow.org/tutorials/images/transfer\_learning |
| 3 | <https://pjreddie.com/darknet/yolo/> |
| 4 | [https://developers.google.com/machine-learning/crash-course/introduction-to-neural-networks/](https://developers.google.com/machine-learning/crash-course/introduction-to-neural-networks/anatomy) |
| 5 | [https://developers.google.com/machine-learning/crash-course/multi-class-neural-networks/](https://developers.google.com/machine-learning/crash-course/multi-class-neural-networks/video-lecture) |
| 6 | https://www.tutorialspoint.com/artificial\_intelligence/index.htm |
| 7 | https://www.w3schools.com/ai/ai\_machine\_learning.asp |

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| **REFERENCE TEXT BOOKS** | |
| 1 | "**Introduction to Artificial Intelligence**" by Wolfgang Ertel, translated by V. S. Janakiraman Wolfgang Ertel's book, translated into English by V. S. Janakiraman, offers a comprehensive introduction to AI concepts and techniques. |
| 2 | "**Artificial Intelligence and Intelligent Systems**" by N. P. Padhy, Ajith Abraham, and B. G. Patra This book provides an introduction to artificial intelligence, intelligent systems, and various AI techniques, with a focus on their applications. |
| 3 | "**Artificial Intelligence: A Modern Approach**" by Stuart Russell and Peter Norvig This comprehensive and widely used textbook covers the fundamentals of AI, including problem-solving, knowledge representation, machine learning, natural language processing, and robotics. |
| 4 | "**Deep Learning"** by Ian Goodfellow, Yoshua Bengio, and Aaron Courville This influential book focuses on deep learning techniques, covering neural networks, optimization, regularization, generative models, and applications in computer vision and natural language processing. |
| 5 | "**Computer Vision: Algorithms and Applications**" by Richard Szeliski This book provides an in-depth exploration of computer vision techniques, including image formation, feature detection, stereo vision, object recognition, and motion analysis. |
| 6 | "**Data Science for Business**" by Foster Provost and Tom Fawcett While not exclusively focused on AI, this book is essential for understanding the application of data science and AI techniques in real-world business scenarios. |

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| **SOFTWARE REQUIREMENT** |
| * Anaconda Navigator |
| * Jupyter notebook / Google Colab |
| * IDE- Spyder / VS Code / Pycharm |
| * Windows 10+, Linux 8+, Mac 10+ |

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| **HARDWARE REQUIREMENT** |
| * Laptop / Desktop with minimumIntel Core i3 Processor or equivalent |
| * Minimum 8 GB RAM |

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| **INDUSTRY SCOPE** |
| The scope of AI in industries is constantly expanding as new applications and use cases are being discovered and developed. Professionals with expertise in AI, deep learning, and data visualization have a wide range of opportunities in both technical and business roles. They can work as AI engineers, data scientists, machine learning specialists, AI consultants, research scientists, and AI product managers, among other positions. With the ongoing growth and advancements in AI technology, the industry demand for skilled professionals in this domain is expected to continue to rise. |

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| **INDUSTRY CERTIFICATIONS** |
| * IBM AI Engineering Professional Certificate * Google Cloud AI Engineer Professional Certificate * Microsoft Certified: Azure AI Engineer Associate * TensorFlow Developer Certificate from Google |

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| **JOB ROLES** |
| 1. AI Engineer/Research Scientist  2. Data Scientist  3. Machine Learning Engineer  4. Natural Language Processing (NLP) Engineer  5. Computer Vision Engineer |

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| **INDUSTRY USE CASES** |
| 1. Bulls eye target detection using transfer learning 2. Fitness Trainer Chatbot using NLP 3. Share price estimation of TOP 5 GPU Companies 4. Curated Colon Disease Classification using Deep Learning 5. Rice Crop Monitoring Time Series Analysis 6. MangoNet: A VGG16-based Neural Network for Mango Classification 7. Microbe Mapper: Visual Recognition of Microorganisms 8. From Pixels to Planks: Deep Learning for Wood Texture Generation 9. Pollen's Profiling: Automated Classification of Pollen Grains   10. Asl- Alphabet image Recognition |

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| Mode of Delivery | Virtual Instructor Led Training + Project Mentoring |
| Software Configuration to be arranged in Institution Premises | Python and related libraries, Anaconda navigator & IDE |
| Hardware Configuration to be arranged in Institution Premises | Windows 10, 8GB RAM, Good Internet Connection |
| Course Evaluation | Online Assessment + Project Evaluation |
| Multiple Hybrid Branch of Students | Applicable for both IT and Non IT |
| Internship/Placement Opportunities | Career Fair will be organized for internships / Placements |
| Train-the-Trainer | Faculty Development Program (30 Hr., Virtual) |

**Assessment & Evaluation**:

Total Score is for 100 Marks which is combination of both online assessment and project evaluation

1. Online Assessment – 30 Marks

2. Project Evaluation – 70 Marks

Project Evaluation will be done by both Industry and Faculty Evaluators with equal weightage of 50% each

**Final Project Score Metrics & Computation**

| **S.No.** | **Evaluation Metric** | **Score** | **Faculty Evaluator Score Weightage** | **Industry Evaluator Score Weightage** | **Faculty Evaluator Score** | **Industry Evaluator Score** |
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| 1 | Technical Training, Assignments & Quizzes | 5 | 50% | 50% | 2.5 | 2.5 |
| 2 | Innovation & Problem Solving | 10 | 25% | 75% | 2.5 | 7.5 |
| 3 | Project Design using Design Thinking | 10 | 25% | 75% | 2.5 | 7.5 |
| 4 | Requirement Analysis using Critical Thinking | 10 | 25% | 75% | 2.5 | 7.5 |
| 5 | Technology Stack | 5 | 25% | 75% | 1.25 | 3.75 |
| 6 | Coding & Solutioning | 15 | 25% | 75% | 3.75 | 11.25 |
| 7 | Solution Performance | 5 | 25% | 75% | 1.25 | 3.75 |
| 8 | Project Documentation | 5 | 25% | 75% | 1.25 | 3.75 |
| 9 | Project Demonstration | 5 | 50% | 50% | 2.5 | 2.5 |
| 10 | Teamwork | 10 | 100% | 0% | 10 | 0 |
| 11 | Time Management | 10 | 100% | 0% | 10 | 0 |
| 12 | Attendance & Punctuality | 10 | 100% | 0% | 10 | 0 |

Final Project Score = Faculty Evaluator Score + Industry Evaluator Score

Final Score = Online Assessment Score + (Final Project Score) \*70%

Ex: if a students score given by industry evaluators is 43 and faculty evaluator is 47

a. Total Project Score = 90 Marks

b. The assessment score for the student is 23 out of 30 Marks, then

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| Final Score of the Student = 23 + 90 \* 70%  = 23 + 63  = 86 Marks |