COURSE HANDOUT (COURSE CURRICULUM)

COURSE TITLE : **ARTIFICIAL INTELLIGENCE**

Credits -4

1. Course Description:

The Artificial Intelligence course syllabus is aimed to impart knowledge about networks, algorithms, and programming skills to create algorithms capable of human-like solutions. This is achieved through the study of Artificial Intelligence subjects including Machine Learning, NLP, Neural Networks, Deep Learning, etc

2. Skills You Will Gain

- Programming languages.
- Data engineering.
- Exploratory data analysis.
- Models.
- Services.
- Deploying.
- Security.

3. The Course Content Enables Students To:

- To study the distinction between optimal reasoning Vs. human like reasoning
- To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- To get an idea on different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving
- To realize problems under uncertainty and acquire machine learning algorithms

4. How the Specialization Courses Works: -

- Take Courses
- Hands-on Project
- End Assessment
- Earn Credit Based Certificate

SYLLABUS:

Module 1: Introduction to Artificial Intelligence

- **What is AI?**
  - History, types, and applications of AI
  - Key concepts: Machine Learning (ML), Deep Learning (DL), and Natural Language Processing (NLP)
- **AI in the Industry:**
  - Case studies in healthcare, finance, manufacturing, and more

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Module 2: Fundamentals of Machine Learning

- **Mathematics for ML:**
  - Linear algebra, probability, and statistics
- **Supervised Learning:**
  - Regression and classification algorithms
  - Case study: Predictive modeling
- **Unsupervised Learning:**
  - Clustering and dimensionality reduction
  - Case study: Customer segmentation
- **Evaluation Metrics:**
  - Accuracy, precision, recall, and F1-score

Module 3: Deep Learning and Neural Networks

- **Introduction to Neural Networks:**
  - Perceptron, activation functions, backpropagation
- **Deep Learning Models:**
  - Convolutional Neural Networks (CNNs) for image processing
  - Recurrent Neural Networks (RNNs) for sequence data
  - Case studies: Image recognition, time-series forecasting
- **Frameworks and Tools:**
  - TensorFlow, PyTorch, and Keras

Module 4: Natural Language Processing (NLP)

- **Text Preprocessing:**
  - Tokenization, stemming, lemmatization
- **Key NLP Techniques:**
  - Sentiment analysis, topic modeling, and named entity recognition
  - Case study: Chatbot development
- **Advanced NLP:**
  - Transformer models (e.g., BERT, GPT)

Module 5: AI for Real-World Applications

- **Computer Vision:**
  - Image classification, object detection, and video analytics
  - Tools: OpenCV, YOLO
- **Recommendation Systems:**
  - Content-based and collaborative filtering
  - Case study: Building a product recommendation system
- **AI in IoT:**
  - AI integration with edge devices

Module 6: AI Ethics and Responsible AI

- **Ethical Considerations:**
  - Bias, fairness, and accountability in AI
- **Privacy and Security in AI:**
  - Data protection regulations (e.g., GDPR)
- **Explainable AI (XAI):**
  - Techniques for interpretability

Module 7: AI Deployment and Scalability

- **AI Model Deployment:**
  - Tools: Flask, FastAPI, Docker
- **MLOps:**
  - Model monitoring, version control, and continuous deployment

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Module 8: Capstone Project

- **Project Development:**
  - Choose a domain-specific problem
  - Develop and deploy a complete AI solution
- **Presentation and Feedback:**
  - Showcase the project to industry experts

Tools and Technologies Covered:

- **Programming Languages:** Python, R
- **Libraries and Frameworks:** TensorFlow, PyTorch, Scikit-learn, NLTK, OpenCV
- **Collaboration Tools:** Git, Jupyter Notebooks

Recommended Books and Resources for AI

- **"Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig** – This is one of the most comprehensive books on AI and is often used as a primary textbook in undergraduate AI courses.
- **"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville** – This book provides a detailed introduction to the concepts of deep learning, making it ideal for students interested in neural networks.

Course Outcomes: -

- Students will be able to define and explain the key concepts of AI.
- Students will be able to identify and apply different AI techniques to solve real-world problems.
- Students will be able to develop and implement AI models using popular programming languages and libraries.
- Students will be able to communicate effectively about AI concepts and applications.

Future of AI Education and Career Prospects:

The future of AI education is bright, with emerging trends such as **AI in healthcare**, **AI ethics**, and **AI for environmental sustainability** becoming key areas of focus. As AI continues to shape industries, the demand for skilled AI professionals will grow. Careers in AI, including roles such as AI engineers, machine learning scientists, and AI research scientists, are expected to see strong growth in 2025 and beyond.

To stay competitive, professionals must continuously update their skills by pursuing AI certifications and staying informed about the latest advancements in the field. The AI job market is dynamic, and individuals with cutting-edge expertise in AI technologies will be well-positioned to lead the future of innovation.

- **Hands-on Project – 4 Hrs**
- **End Assessment – 1 Hr (50 Questions)**
- **Earn Credit Based Certificate**