

# Artificial Intelligence and Edge Computing

## Program Description

<b>Course Name</b>	<b>Artificial Intelligence and Edge Computing</b>
<b>Course Name as on Certificate</b>	<b>Certification in Artificial Intelligence and Edge Computing</b>
<b>Certificate Type</b>	Certificate of Completion by IITM Pravartak and L&T EduTech
<b>Certificate Issued by</b>	IIT MADRAS and L&T EduTech
<b>*Course Description</b>	<p>This course on 'Artificial Intelligence and Edge Computing' is a first level course for aspiring engineers of Edge Computing/IoT/AI developers to acquire practice-based AI/Machine Learning skills and Edge Computing fundamentals. The course has been designed with a clear vision on future developments of Edge Computing in industrial applications along with a mission of importing all essential learning fundamentals for the undergraduate engineers. The course has been weaved with necessary fundamentals of applied mathematics and python programming to inculcate the practicing skills of design and development of machine learning algorithms. The course contents are meticulously presented so that the learner will be able to visualize the applied areas of ML algorithms and to correlate &amp; decide the preferences among Cloud, Fog and Edge Computing. The concepts on the designing of Edge Computing Systems are provided with perfect demonstrations through TensorFlow and TensorFlow lite frameworks, which provide complete learner engagement. During the course, the instructional model is designed to ensure that the learner has opportunities to explore modular tasks using retrospectives and to gain Higher order thinking skills. The course elevates the learner's practical experience using edge computing hardware demos. The learners will also be assured with the outcomes by executing an in-course project module.</p> <p><b>Objective:</b></p> <ul style="list-style-type: none"> <li>➤ Introduce composite relational model of edge computing along with AI, Machine Learning and IoT</li> <li>➤ Impart the ML and IoT frameworks suitable for Edge Computing</li> <li>➤ Elevate the learners with a knowledge and practice on tools supporting for ML, DL and Edge Computing solutions</li> <li>➤ Offer pilot training on modular development boards of Tiny ML</li> </ul>
<b>*Educational Qualification</b>	<ul style="list-style-type: none"> <li>• Students pursuing Diploma / UG / PG Programs in Civil, Electrical &amp; Electronics, Mechanical, Computer Science, IT etc.</li> <li>• Faculties in the field of Civil, Electrical &amp; Electronics, Mechanical, Computer Science, IT etc.</li> <li>• Working professionals in the above domains</li> </ul>
<b>Pre Requisites</b>	Basics of Python Language
<b>Course Content</b>	<b>See Enclosed Programme details – as Annexure 1</b>
<b>Pedagogy</b>	Online Self paced E-Learning Content

<b>Assessment</b>	One Final Assessment		
<b>Programme Faculty</b>	<p><b>Dr. Venkatalakshmi B, Subject Matter Expert – L&amp;T EduTech</b></p> <p>A passionate Educator with Teaching Research Nexus skill set. With 26-years of experience in Engineering Education, her contributions are holistic which covers Teaching, Research and Administration. As a recipient of IBM-US Faculty Innovation award 2010 on Smarter Planet Scheme, she is an enthusiastic member working in design and development of Engineering Curriculum, Teaching Pedagogies and Evaluation strategies for the Engineering fraternity.</p>		
<b>Duration</b>	Weeks: 14 ; Hours : 28hrs		
<b>Class Schedule</b>	Self Paced		
<b>*Programme Highlights/USPs</b>	<ul style="list-style-type: none"> <li>• <b>Industrial Applications based on domains of Civil, Electrical and Mechanical</b></li> <li>• <b>General Applications of ML in Healthcare, Education, Finance etc.,</b></li> <li>• <b>Tiny ML principles and implementation</b></li> </ul>		
<b>Total Fees</b>		<b>Total Fees</b>	
	Total Programme Fee	Rs. 5,100/- inclusive of Tax	Total Programme Fee

## ANNEXURE 1

Proposed Course outline / programme / plan - Unit wise syllabus details.

### **Unit – I: Artificial Intelligence (AI) and its Next Wave - Edge Computing, Programming**

#### **Fundamentals - A backbone for AI and Edge Computing**

AI & Edge Computing - Course Description, Relational Model of AI and Edge Computing, ARTIFICIAL INTELLIGENCE(AI) PRINCIPLES AND PRODUCTS, Machine Learning (ML) Fundamentals and Principles, Application of ML in Manufacturing and Production Industries, Diesel Generators with IoT Framework - A Model IoT Architecture, Quick Tour on Edge Devices in IoT, Edge AI and Cloud AI - An Overview, 'TinyML' – A Cutting Edge Field, Case Study on 'Edge AI Practices in Industrial Applications', Introduction to Python, Python Internals, Programming Essentials in python Part I and II, DEMO PROGRAMS IN PYTHON - Beginners Perspective, DEMO PROGRAMS IN PYTHON - Beginners Perspective, Machine Learning Libraries and Functions in Python, House Price Prediction with Sklearn Framework, Working with Data for ML - Demo with Kaggle Data set, Working with Micropython - An Overview, Python in " Deep Learning for Self-Driving Cars " - A case study approach.

Demos on:

- Demo programs in Python and House price prediction.

### **Unit – II: Python Demos and Case-Studies on Machine Learning (ML) Algorithm Fundamentals, Demonstrating Unsupervised & Reinforcement Machine Learning Algorithms with Python demos, Principles and successful demonstrations of Neural Networks (Text Analytics), Advanced Applications with Deep Learning Networks**

MACHINE LEARNING ALGORITHMS ARCHITECTURE, Big Data in the context of Machine Learning, Machine Learning Types & Algorithm Selection Strategy, Bias and Variance - Trade-off, Machine Learning Strategies for Business Improvement – An Overview, Preparing Data for Optimization in Production Manhours, Supervised Machine Learning Algorithm- Principle and types, Regression algorithm, Classification algorithm, Implementation framework of ML algorithms, Implementation framework of ML algorithms, PRINCIPLES OF UNSUPERVISED MACHINE LEARNING ALGORITHM, Clustering algorithm, DBSCAN clustering algorithm, DIMENSIONALITY REDUCTION ALGORITHM – PRINCIPLE & IMPLEMENTATION OF PCA, Linear Discriminant Analysis - A Quantitative Approach, Autonomous vehicle embedded with Dimensionality Reduction Algorithm, REINFORCEMENT MACHINE LEARNING ALGORITHM – WITH A PRACTICE APPROCH IN HVAC SYSTEM, MODEL BASED RL ALGORITHMS – PRINCIPLE AND EXAMPLE WITH DYNA Q ALGORITHM, Paradigm shift in health care diagnosis with reinforcement learning - a review exercise, Model Free Reinforcement learning – exploring policy based methods, DEPLOYMENT OF DEEP Q-LEARNING IN PICK AND PLACE COBOT - An Industrial application of ML, FUNDAMENTALS OF NEURAL NETWORK, DIGIT RECOGNITION USING MLP MODEL – HANDS-ON PRACTICE, GRADIENT DESCENT ALGORITHM- WORKING PRINCIPLE, BACKPROPAGATION ALGORITHM – WORKING PRINCIPLE, Cross-Entropy cost function and its implementation using MLP, Overfitting and Regularization principles with a hands-on approach, DIGIT RECOGNITION SYSTEM FOR VISUALLY IMPARED – CNN BASED ML ALGORITHM, STOCHASTIC GRADIENT DESCENT ALGORITHM PRINCIPLE AND ANALYSIS USING IRIS DATASET, Simulation of

Neural Networks - Weka tool based exercise, Strategic deployment of shallow neural network for enhancing agriculture - a review exercise, VANISHING GRADIENT PRINCIPLES AND ITS MEASUREMENTS IN SIGMOID ACTIVATION FUNCTION, Unstable Gradient in Complex networks, Unstable Gradient in Complex networks, Introduction to convolutional neural networks, Introduction to convolutional neural networks, Applications of CNN, Generative Network Principles, Introduction to RNN, Properties and Construction of RNN, Implementation of RNN for NLP, Case-Study on Recommendation Systems

Demos on:

- Bias and Variance, EDA, Classification on Iris dataset using SVM, Salary Prediction, EV Vehicle Purchasing, Lung Cancer Prediction, K-Means Clustering, DBSCAN Clustering, PCA, Reinforcement Learning, Digit Recognition Using MLP, Backpropagation Algorithm, Cross Entropy, Overfitting and Regularization, Digit Recognition for Visually Impaired, Stochastic Gradient Descent, WEKA Simulation, Vanishing Gradient, Unstable Gradient, Pneumonia Detection and NLP.

### **Unit - III: IoT Architecture and Development model of Edge Computing, Software platforms and tools for Edge Computing, Hardware tools and resources for Edge Computing**

IoT General Architecture, IoT Architecture with AI, Case-Study Analysis, Issues and Challenges in IOT with Cloud AI, Revised IOT Architecture with Fog AI and Edge AI, Tiny ML working principle, Tiny ML as SaaS model, High Computing Machine based Edge Architecture, Distributed Training, Compression technique, Case Study-1 on flow sensing with totalizer, Case-Study-2 on Water management in public utilities, Software tools and their scope for AI and ML, Additional software requirements for Tiny ML, Example IDE for ML – Colab, Libraries required for ML, Tensor Flow Library – Principles, Keras Library – Principles, Arduino IDE for Edge Computing, Tensorflow Lite – Principles, Example – ML, Example - ML with ANN, Example - Tiny ML AI based Software development methodologies, Quick survey on the hardware resources, Basics of Arduino Nano BLE Board, Programming with Arduino Nano BLE(ANB), Programming with built-in Sensors in ANB, Design framework for Edge computing in ANB, Sinewave prediction model analysis, Demonstration using ANB, Word Detection model using ANB, Person Detection Model using ANB, Magic Wand model using ANB

Demos on:

- Diesel Level Monitoring, Crop Analysis, Edge Impulse, WEKA, Blink, Air Quality Monitoring, Garbage Classification, Gesture Initial Model, Evolution of Software Development Methodologies, Colors Blink, Microphone & IMU (Gesture Recognition), Sine wave prediction, Wake Word and Magic Wand

**Unit - IV: ML algorithms and scope for Edge Computing in Electrical Engineering Applications, ML algorithms and scope for Edge Computing in Mechanical Engineering Applications, ML algorithms and scope for Edge Computing in Civil Engineering Applications**

Basics of Substation, ANN Architecture for Substations, Load Prediction in Substations - A case Study, Geo-spatial database for power infrastructure, Feature Extraction of substation using Deep Learning- A Case study, Power grid stability and secondary substation model, Estimation of unknown secondary substation profile - A case study, Characterization of substation site features- Practitioner approach, CNN based preliminary siting of substation - A Case Study, Substation Device Diagnosis using unsupervised ML algorithm, CNN based Infrared Fault Image Diagnosis - A Case Study, Impact of ML in O&G Industry - A Review, Seismic Data Processing Techniques, Geomodeling Process, ML in Reservoir Engineering, Optimal Production Engineering in O&G Industry, AI in upstream sector of O&G Industry, Advances in AI Technology for O&G Industry, Fundamentals of Data handling in O&G Industry, SOA of big data for O&G Industry ML for Civil Engineering, Cloud Data collection about the Construction Site, Generic ML modelling framework for Civil Engineering Applications, Deep Learning Techniques in Construction Industry, ML approach for Construction Management, CNN based Planetary Lego Brick, AI in Transport Engineering - A Survey, Road Traffic Prediction - Bayesian Approach, ML for Naval Architecture, AI based Wave Height Forecasting - A Case Study

Demos on:

- Energy Prediction, Solar Energy Power Generation Analysis, Feature Extraction Substation using Deep Learning, Estimating the Power Grid Stability - A Hands on Approach, Practitioner approach, Fault Detection in Power Line System, Diesel Price Prediction, Salt Dome Detection, Reservoir Simulation, Well Bore Testing in Oil and Gas Industry, Stock Price Prediction for Oil and Gas Industry, Concrete Compressive Strength Prediction, IIoT Data Collection for ML Algorithms, Building Crack Detection, Classification of LEGO Bricks, Road Traffic Prediction and Ship Classification

**Unit - V: Real-Time Applications of ML - A Structured Approach and Demos, ML algorithms and scope for Edge Computing in Future**

Automated Vehicle support using ML, Fraud System Diagnosis using ML, Deep learning based shop floor management, Neural networks based ground water quality distribution analysis, Potential applications of AI in Healthcare – Discussion, Image Classification in IoT Devices - Case Study, Remotely Piloted Aircraft - Case Study, AI Products - A survey, Education Quality updates in Design, Development and Delivery using ML, AI impacts in Education, AI open source software libraries, Computer Vision (Image and Video), Language and Language Reasoning, Speech Recognition, Healthcare and Biology, Ethical Challenges in AI, Economy Implications due to AI, Policies and Strategies for AI

**Demo on:**

Email Spam Detection, Bosch Performance Line, Diabetic Retinopathy, Edge Impulse -Flower, Forest Fire, Graduate admission prediction, Car object detection, Language prediction, Speech recognition, Heart disease prediction and L&T Stock data analysis.