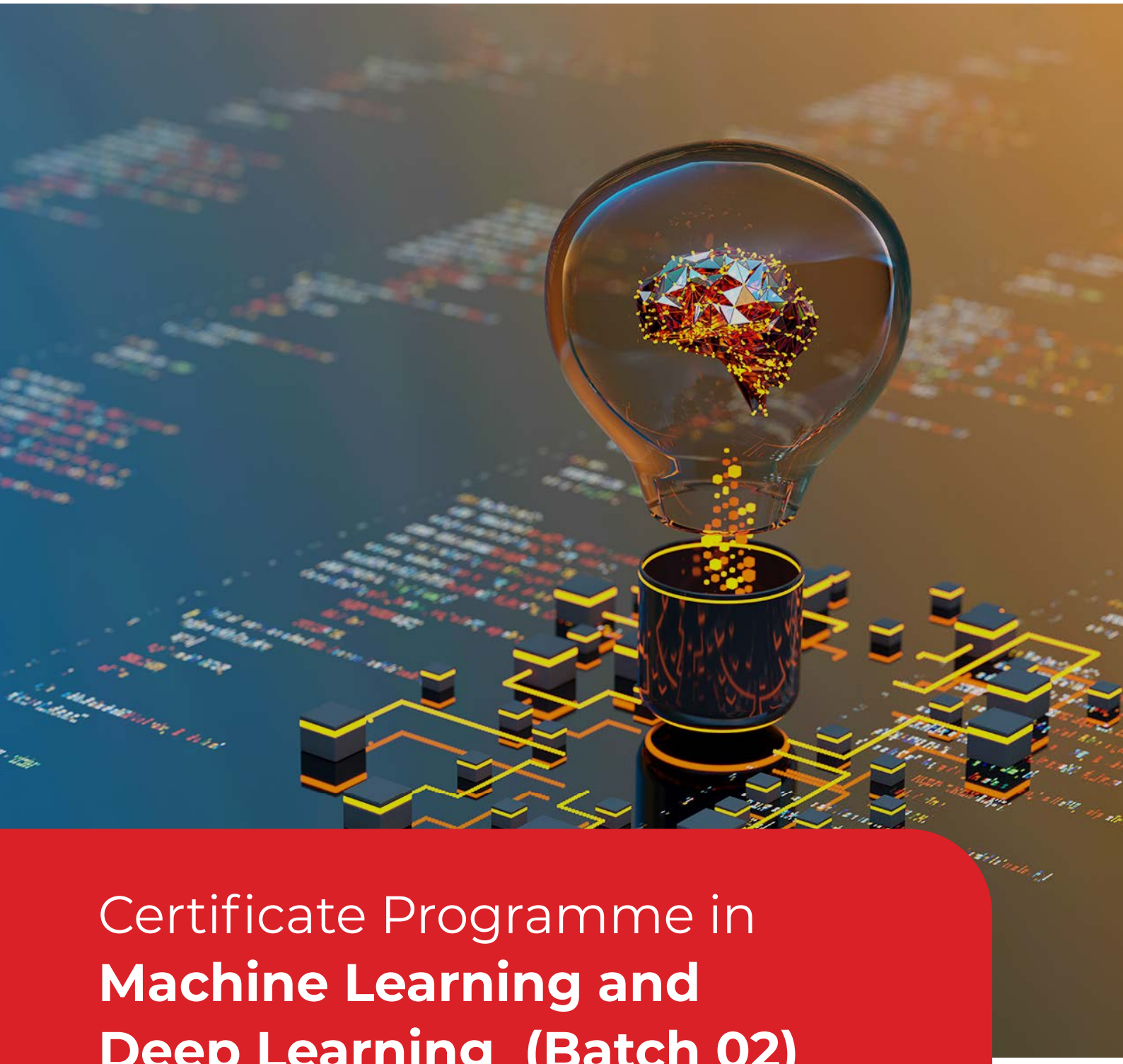
भारतीय प्रौद्योगिकी संस्थान दिल्ली
Indian Institute of Technology Delhi



Certificate Programme in **Machine Learning and Deep Learning (Batch 02)**

06 Months | Starts 30th September, 2023 | Live Online Lectures

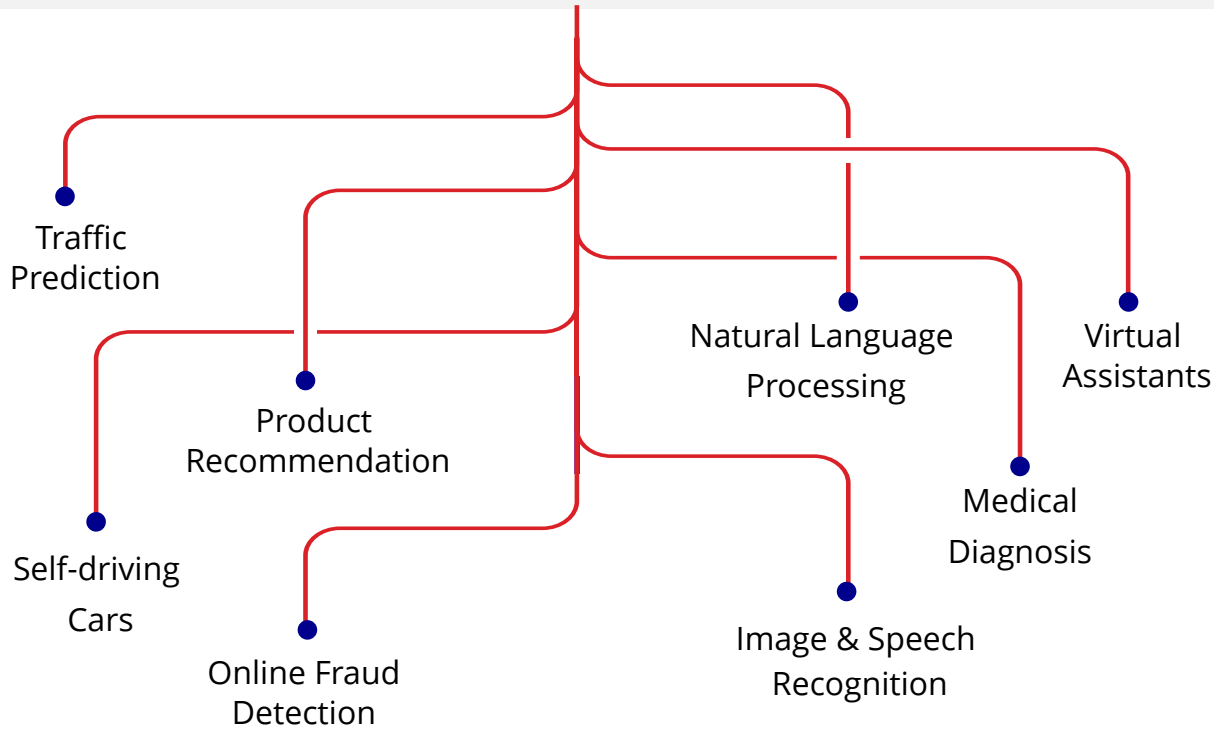
Programme offered by Continuing Education Programme (CEP), IIT Delhi

Machine Learning & Deep Learning

Machine Learning (ML) and Deep Learning (DL) are the two main pillars of Data Science and are the subsets of Artificial Intelligence. ML integrates computer science and statistics to recognise patterns and make predictions from data and perform specific tasks without being explicitly programmed. DL, a subset of ML, uses algorithms that analyse data with a logic structure, called Artificial Neural Network (ANN) that mimics the human thinking process. In general, the learning process of these algorithms can either be supervised or unsupervised, depending on the data being used to feed the algorithms.

While the global market for ML is projected to grow from $17.1 billion in 2021 to $90.1 billion by 2026, the DL market is estimated to grow from $12.3 billion in 2021 to $60.5 billion by 2025 (bccresearch.com).

Machine Learning & Deep Learning Applications



We are living in the era of big data where massive amounts of data are generated every second. Thanks to the applications of Machine Learning and Deep Learning, yesterday's sci-fi has become today's reality. Acquiring skills and competencies in these technologies of the future will go a long way in securing your own future in this exciting domain.

Certificate Programme in Machine Learning and Deep Learning

Programme Highlights

A programme from the Department of Electrical Engineering, IIT Delhi. IIT Delhi is ranked #3 as per QS World University Rankings 2023 in India and # 49 globally as per the QS World University Rankings by Subject 2023: Electrical and Electronic Engineering

6-month online training programme for working professionals

72 hours of live online teaching

IIT Delhi Continuing Education Programme (CEP) certificate

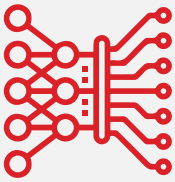
Who Should Attend?

- Graduates from science or engineering background seeking a career in the ML/DL domain
- Professionals in the software and IT industry seeking to upskill with ML/DL expertise and applying this intelligent learning tool in their respective fields
- Professionals aspiring to work as data engineers, data scientists, machine learning engineers, etc.

Learning Outcomes

After completing this programme, the participants should be able to:

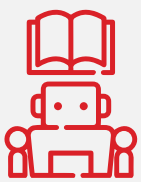
Have a good grasp of efficient Python programming including developing the skill to load and pre-process the data from online and offline databases using pandas



Have a good understanding of the fundamental aspects and challenges of ML: data, model selection, model complexity, etc.

Understanding of the strengths and weaknesses of popular ML approaches

Able to design and train your own neural networks using Keras and TensorFlow modules



Able to design and implement various ML/DL techniques in a range of real-world applications

Programme Curriculum

Module 1: Programming with Python

- Foundations of Python Programming
- Data Structures, Loops, and Control Structures
- Functional Programming in Python
- Linear Algebra using NumPy
- Data Pre-processing using Pandas
- Data Visualisation using Matplotlib
- Scikit-learn

Module 2 : Mathematical Foundations

- Linear Algebra: Vectors, Matrices, Norms, Subspaces, Projections, SVD, EVD, Derivatives of matrices, Vector Derivative Identities, Least Squares
- Optimization: Gradient Descent, Second Derivative Test, Constrained Optimization, KKT
- Probability Theory: Discrete and Continuous Random Variables, Conditional Probability, Joint Probability Distribution, Multivariate, MAP Criterion, ML Criterion

Module 3 : Machine Learning and Neural Networks

- Introduction to AI/ML/DL and Data Analysis
- Linear Regression Model
- Introduction: Supervised & Unsupervised Learning, Classification & Regression Models
- Bayesian Decision Theory: Bayesian Classifier, Discriminant Functions, Minimum Error Rate Classification
- Naïve Bayes Theory with Example
- Logistic Regression Model
- Parameter Estimation-Maximum Likelihood
- Principal Component Aanalysis
- Non-parametric Techniques: K-nearest Neighbor, Density Estimation
- Decision Tree with Example (Entropy, Gini Impurity Index)

- Neurons, Perceptron, Multilayer Perceptron, LMS, Feedforward Operation, Backpropagation Algorithm, Activation Function, Loss Function, XOR Problem, Cross-validation, Regularisation, Demonstration on Classification and Regression Applications
- Radial Basis Functions and K-means Clustering
- Support Vector Machine (SVM)
- Random Forest, Ensemble Learning, Bagging, Boosting

Module 4: Deep Learning

- Basics of Deep Learning
- Deep Learning Architectures: DNN, CNN, RNN, LSTM, Autoencoder
- Methodology and Applications
- Demonstration of Deep Learning Applications

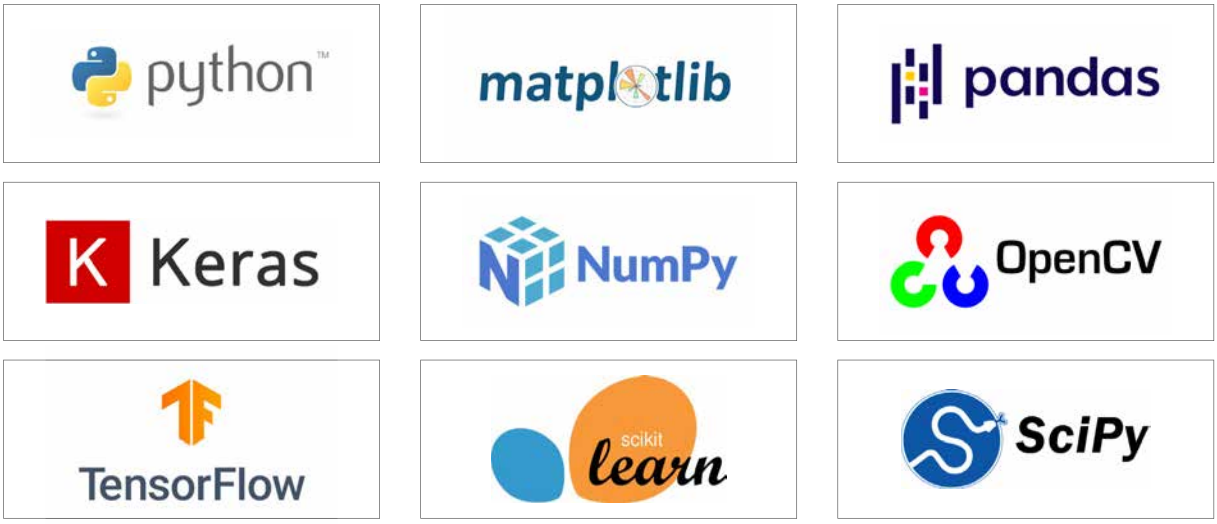
Module 5: Applications of Machine Learning

- Computer Vision
- Speech Recognition
- NLP

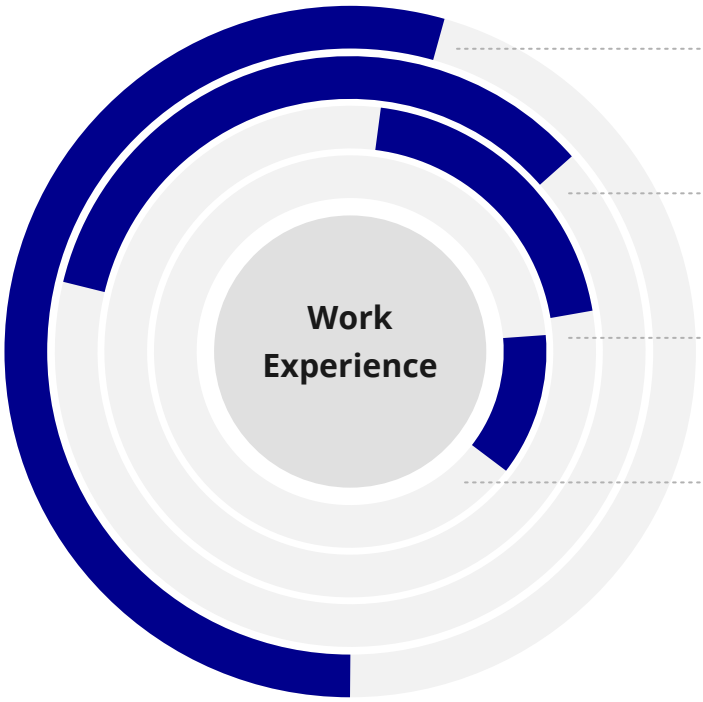
Note:

- There will be 2 masterclasses on the advanced topics like ChatGPT, etc.
- Modules may include assignments

ML/DL Tools Used



Past Participants Profile



- **<4 Yrs**
  52%
- **5 to 9 yrs**
  29%
- **10 to 14 yrs**
  13%
- **15+yrs**
  6%

Industries

54%
IT Services

7%
BFSI

4%
Education

7%
Manufacturing

4%
Media

24%
Others*

*Others include Construction, Real Estate, Logistics, Biotechnology, Health Care, Consulting and Consumer Services, amongst others.

Hands-on Projects and Case Studies

MNIST digit recognition using DNN, CNN, and SVM

Sentiment Analysis using Naïve Bayes Classifier

Classification of Real news and Fake news using decision trees

Prediction of the iris flower species using Naïve Bayes classification

Image Compression using K-means Clustering

Classify Photos of Dogs and Cats using Deep Convolutional Neural Network

To build a movie recommender model using K-means clustering

Identification of IoT devices using experimental radio spectrum dataset and deep learning

German Traffic Sign Recognition Benchmark

CIFAR-10 Object Recognition

Credit Card Fraud Detection using Random Forest Classifier

Application of Deep Learning in Medical Diagnosis using Health Data

Music Recommendation System using K-NN Algorithm.

Programme Details

Duration
- 6 Months
- 72 Hours of Live Online Learning
- 2-Hour Sessions

Delivery
Live Online Sessions delivered Direct-to-Device (D2D)

Class Schedule
Saturday and Sunday: 10:00 a.m. to 12:00 p.m.*
*Timings are subject to change

Campus Event/Immersion
1 day for interaction with candidates (optional)

Eligibility
Any science or engineering graduate with at least 1 year of experience.

Admission Criteria
Selection based on application review

Evaluation
- 50% - end of programme MCQ-based exam
- 40% - assignments/quizzes
- 10% - attendance
- For Certificate of Completion: Candidates need to secure minimum 50% overall marks with 50% minimum attendance

Certification*

- Candidates who score at least 50% marks overall and have a minimum attendance of 50%, will receive a 'Certificate of Successful Completion' from CEP, IIT Delhi.
- Candidates who score less than 50% marks overall and have a minimum attendance of 50%, will receive a 'Certificate of Participation' from CEP, IIT Delhi.

*Only e-certificates will be issued by CEP, IIT Delhi.

The organising department of this programme is the Department of Electrical Engineering, IIT Delhi.

Programme Faculty

Dr. Manav Bhatnagar
Professor,
Department of
Electrical Engineering,
IIT Delhi

Dr. Manav Bhatnagar is currently a Professor with the Department of Electrical Engineering, IIT Delhi, New Delhi, India, where he is also a Brigadier Bhopinder Singh Chair Professor. He holds a global rank of 517 in the area of Networking & Telecommunications among the top 2% scientists in a global list compiled by the prestigious Stanford University. He is a Fellow of IET, INAE, NASI, IETE, and OSI. He has received the prestigious NASI-Scopus Young Scientist Award, Shri Om Prakash Bhasin Award, and Dr. Vikram Sarabhai Research Award. He has been an Editor of the IEEE Transactions on Wireless Communications during 2011-2014. Currently, he is an Editor of the IEEE Transactions on Communications. He has published more than 100 high quality IEEE journal papers out of which 10 are single-authored. His research interests include signal processing for MIMO systems, free-space optical communication, satellite communications, and machine learning.

Dr. Manoj B R
Assistant Professor,
Department of
Electronics and
Electrical Engineering,
IIT Guwahati

Dr. Manoj B R is an Assistant Professor in the Department of Electronics and Electrical Engineering at the Indian Institute of Technology Guwahati, India. He received a B.E. degree in Electronics and Communication Engineering from the Visvesvaraya Technological University, India, in 2007, a M.Tech. degree in Signal Processing from the Indian Institute of Technology Guwahati, in 2011, and a Ph.D. in Wireless Communications from the Indian Institute of Technology Delhi, in 2019. He has gained a mixed exposure of academic and industrial backgrounds. Before joining IIT Guwahati, he was an Early Doctoral Research Fellow with the Indian Institute of Technology Delhi; a Postdoctoral Researcher with the Division of Communication Systems, Department of Electrical Engineering, Linköping University, Sweden; and a Senior

Researcher with the Radio Transmission Technology Lab, Huawei Technologies, Stockholm, Sweden. His research interests include wireless communication and networks, machine learning, deep learning for wireless communications and signal processing, security and robustness of deep learning-based wireless systems, large-scale sensing using radio signals, buffer-aided relaying networks, Markov chains and their applications, diversity combining, and multi-hop communications.

Dr. Anirban Dasgupta
Assistant Professor, Department of Electronics and Electrical Engineering, IIT Guwahati

Dr. Anirban Dasgupta is an Assistant Professor in the Department of Electronics and Electrical Engineering, Indian Institute of Technology (IIT) Guwahati. He has received his doctorate (Ph.D.) in Electrical Engineering from the Indian Institute of Technology Kharagpur in 2019, Master of Science (MS) by research in Electrical Engineering from the Indian Institute of Technology Kharagpur in 2014 and Bachelor of Technology (BTech) in Electrical Engineering from the National Institute of Technology, Rourkela in 2010. He was the co-founder of the start-up company 'Humosys Technologies Private Limited', and worked there as a Chief Technical Officer (CTO) from January 2019 to July 2021. He joined Boeing India Private Limited, Bengaluru, in July 2021 as a Data Scientist, and worked there till November 2021. From December 2021 onwards, he is with IIT Guwahati. He has ten publications in peer-reviewed international journals, which include five IEEE Transactions. He also has filed three Indian patents, and published 16 IEEE conferences and one book chapter. His research areas include machine learning, internet of things, digital signal and image processing for human cognition, and affective computing. He has served as a reviewer in more than 10 journals which include IEEE Transactions on Signal Processing, IEEE Transactions on Image Processing, IEEE Transactions on Pattern Recognition and Machine Learning.

Dr. Aashish Mathur
Assistant Professor,
Department of
Electrical Engineering,
IIT Jodhpur

Dr. Aashish Mathur (Senior Member, IEEE) received the B.E. degree (Hons.) in Electronics and Instrumentation Engineering from the Birla Institute of Technology and Science, Pilani, Rajasthan, India, in 2011, the M.Tech. degree in Telecommunication Technology and Management from IIT Delhi, New Delhi, India, in 2013, and the Ph.D. degree in power line communications from the Department of Electrical Engineering, IIT Delhi. He was a Software Engineer with Intel Technology India Pvt. Ltd., Bangalore, India briefly before joining IIT Delhi for his PhD in 2013. He is currently an Assistant Professor with the Department of Electrical Engineering, IIT Jodhpur, India. He has also worked as an Assistant Professor with the Department of Electrical and Electronics Engineering, BITS Pilani, Pilani Campus and the Department of Electronics Engineering, IIT (BHU), Varanasi. He was engaged as a visiting faculty at the Indian Institute of Information Technology, Kota, India for the 2nd Semester, 2018-19. He received the Best Student Paper Award for his co-authored paper in 2017 Conference on Decision and Game Theory for Security (GameSec 2017), Vienna, Austria. He was awarded the Early Career Research Award by the Science and Engineering Research Board, DST, Govt. of India in 2019. He was awarded the Teaching Excellence award at IIT Jodhpur in 2019. He served as an Adjunct Faculty (Part-Time) from 2019-22 on the 5G testbed project at IIT Delhi. He was recognized as Exemplary Reviewer 2021 for IEEE Transactions on Communications. His research interests include power line communications, visible light communications, free-space optical communications, and physical layer security. He has published research papers in reputed IEEE journals and conferences. Some of his research works have appeared as popular articles in IEEE Communications Letters. He has also served as a reviewer for reputed IEEE journals and conferences.

Nayan Moni Baishya
Senior Research Scholar, Department of Electronics and Electrical Engineering, IIT Guwahati

Nayan Moni Baishya is a Senior Research Scholar in the Image Processing and Computer Vision (IPCV) Lab at the Department of Electronics and Electrical Engineering, IIT Guwahati, under the guidance of Prof. P.K. Bora and Prof. Salil Kashyap. His current research interest focuses on developing end-to-end deep learning (DL)-based systems for image manipulation detection and localization. He is also a Junior Research Fellow under Prof. Manoj BR, working on the project "Secure and Reliable Techniques for Deep Learning-based 5G and Beyond Wireless Systems". He received his B. Tech. degree in Electronics and Electrical Engineering from IIT Guwahati in 2016. His broader research interests include Computer Vision, Multimedia Forensics, Applied DL, and DL security. He has 7+ years of practice experience in applying ML and DL algorithms for different problem scenarios, with in-depth technical expertise in Python, TensorFlow, PyTorch, Scikit-learn, NumPy, etc. He has conducted workshops on foundations and applications of ML and DL at IIT Guwahati.

Dr. Pratiti Paul
Research Assistant, (Post-doc)
University of Edinburgh, United Kingdom

Dr. Pratiti Paul received her Ph.D. from the Indian Institute of Technology, Delhi in 2023. She is currently working as a Research Assistant (Post-doc) at the University of Edinburgh, UK. She has published multiple research papers in reputed peer-reviewed IEEE journals and conferences. She is also serving as a technical reviewer for IEEE Transactions on Communication. Her research interests include free-space optical communications, multiple-input multiple-output systems, radar signal detection, signal processing, physical layer security, and machine learning applications in wireless communications.

Testimonials

Mathematics can do magic! During my academic years I was just doing the math to pass exams, but after this course, I know now from here where I need to go. I had to go through the recordings 3-4 times but every time I learned something new and understood why IIT is awesome.

Brajesh,
System Administrator

Now I have an in-depth understanding of how any AI application works. I am confident that I can explore and innovate some new AI-based applications for our OTT/Broadcast industry. Overall, excellent experience and a very knowledgeable faculty.

Sunil
IT Engineer

Programme Fees

Particulars	Amount (₹)
Programme Fee	1,60,000
GST@18%	28,800
Total	**1,88,800**

Instalment Schedule

Instalment	Date	Amount (₹)**
Registration Fee*	To be paid at the time of application	10,000
I	To be paid within 7 days of offer roll out	50,000
II	10th November, 2023	50,000
III	10th December, 2023	50,000

Note:

The registration fee of ₹10,000 is part of the programme fee and will be adjusted in the total fee after the selection in the programme.

An offer letter from CEP, IIT Delhi will be released post-selection and the successful receipt of the Registration Fee.

All fees should be submitted in the IITD CEP Account only, and the details will be shared post-selection by CEP IITD.

**GST@ 18% will be charged extra in addition to the fee.

Programme Timelines

Application Closure Date	18th September, 2023
Programme Start Date	30th September, 2023
Programme End Date	March 2024

APPLY NOW

भारतीय प्रौद्योगिकी संस्थान दिल्ली
Indian Institute of Technology Delhi

The Indian Institute of Technology Delhi (IIT Delhi) is one of the 5 initial IITs established for training, research, and development in science, engineering, and technology in India. Established as the College of Engineering in 1961, the Institute was later declared an Institution of National Importance under the “Institutes of Technology (Amendment) Act, 1963” and was renamed as “Indian Institute of Technology Delhi”. It was then accorded the status of a Deemed University with powers to decide its own academic policy, conduct its own examinations, and award its own degrees. Since its inception, over 48,000 students have graduated from IIT Delhi in various disciplines including Engineering, Physical Sciences, Management, and Humanities & Social Sciences.

For more details, please visit: www.iitd.ac.in

Continuing Education Programme (CEP)

Executive education is a vital need for companies to build a culture that promotes newer technologies and solutions and builds a workforce that stays abreast of the rapidly transforming needs in the technological, business, and regulatory landscape. Committed to the cause of making quality education accessible to all, IIT Delhi has launched Online Certificate Programmes under eVIDYA@IITD (ई-विद्या @IITD), enabling Virtual and Interactive learning for Driving Youth Advancement @IITD for Indian as well as international participants.

These outreach programmes offered by the Indian Institute of Technology Delhi (IIT Delhi) are designed to cater to the training and development needs of various organisations, industries, society, and individual participants at national and international levels with a vision to empower thousands of young learners by imparting high-quality Online Certificate Programmes in cutting-edge areas for their career advancement in different domains of engineering, technology, science, humanities, and management.

For more details, please visit: http://cepqip.iitd.ac.in

2nd in NIRF Ranking 2023 (Engineering)	4th in Outlook ICARE Rankings 2022 (Engineering)	3rd in QS World University Rankings 2023 in India

Services provided by:

TIMESPRO

TimesPro, 18th Floor, G-02 Wing,
Lotus Corporate Park,
Off Western Express Highway,
Jogeshwari (E), Mumbai – 400 063, India.

1800-120-2020
admissions@timespro.com
www.timespro.com

For any feedback, please write to:
CEP, IIT Delhi at
contactcep@admin.iitd.ac.in

Online Certificate Programmes are offered by the Indian Institute of Technology Delhi under the aegis of Continuing Education Programme (CEP) so that the Institute can realise its vision of serving as a valuable resource for industry and society, and fulfil its mission to develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.