PREPARE FOR THE FUTURE OF COMPUTING
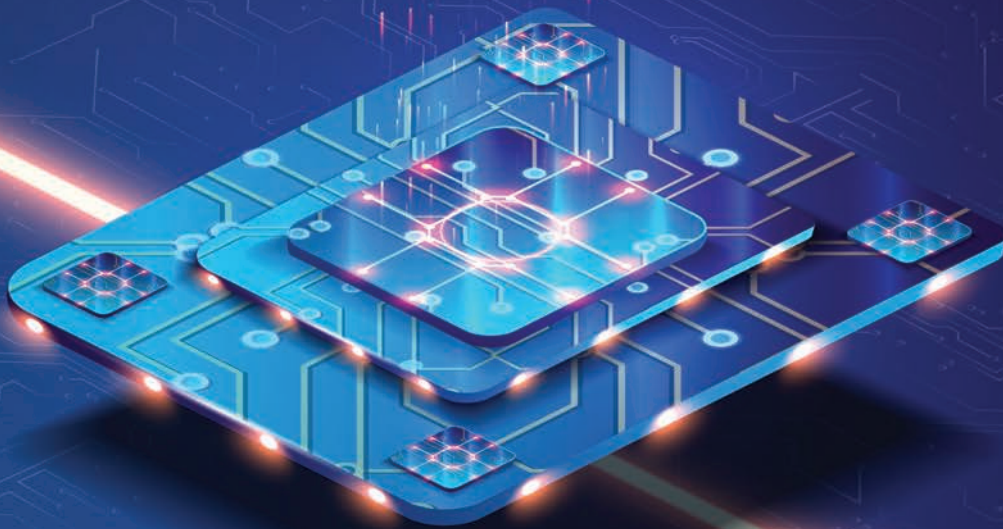
Certification in
Quantum Computing & Machine Learning

5 Months | Starts 9th July, 2022 | Live Online Lectures + Tutorials

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

QUANTUM COMPUTING

Quantum computing is a convergence of physics, mathematics, and programming to develop computer-based technologies centred around the principles of quantum theory. Quantum computing uses phenomena in quantum physics to create new ways of computing. It offers an ability to write programs in a completely new way. Quantum computing is made up of qubits that, unlike a classical computing bit, can be either 0 or 1, or a superposition of both 0 and 1. The power of quantum computers grows exponentially with more qubits.

QUANTUM MACHINE LEARNING (QML)

Quantum machine learning is the integration of quantum algorithms within machine learning programs. It commonly refers to machine learning algorithms for the analysis of classical data executed on a quantum computer, i.e. quantum-enhanced machine learning.

POTENTIAL APPLICATIONS OF QML

Finance	Cryptology & Intelligence	Drug Design & Discovery	Aerospace Design
Polymer Design	Big Data search	Digital Manufacturing	Complex Simulations (Nuclear Fusion)

CERTIFICATION IN QUANTUM COMPUTING & MACHINE LEARNING

PROGRAMME HIGHLIGHTS

5-month, online programme for engineering graduates with proficiency in math and programming

Comprehensive and contemporary curriculum

55 hours of live online teaching on weekends

IIT Delhi Certification

WHO SHOULD ATTEND?

The programme is ideal for engineering graduates with proficiency in Mathematics & Programming.

- Working computer science professionals who would like hands-on experience in technologies of the future

- Young engineering graduates wishing to be a part of the exciting and evolving future of computing

KEY LEARNING OUTCOMES

01 Principles of Quantum Computing

02 Fundamental differences between Conventional Computing & Quantum Computing

03 Various Quantum Computing Algorithms

04 Applications of Quantum Computing in Machine Learning and Deep Learning
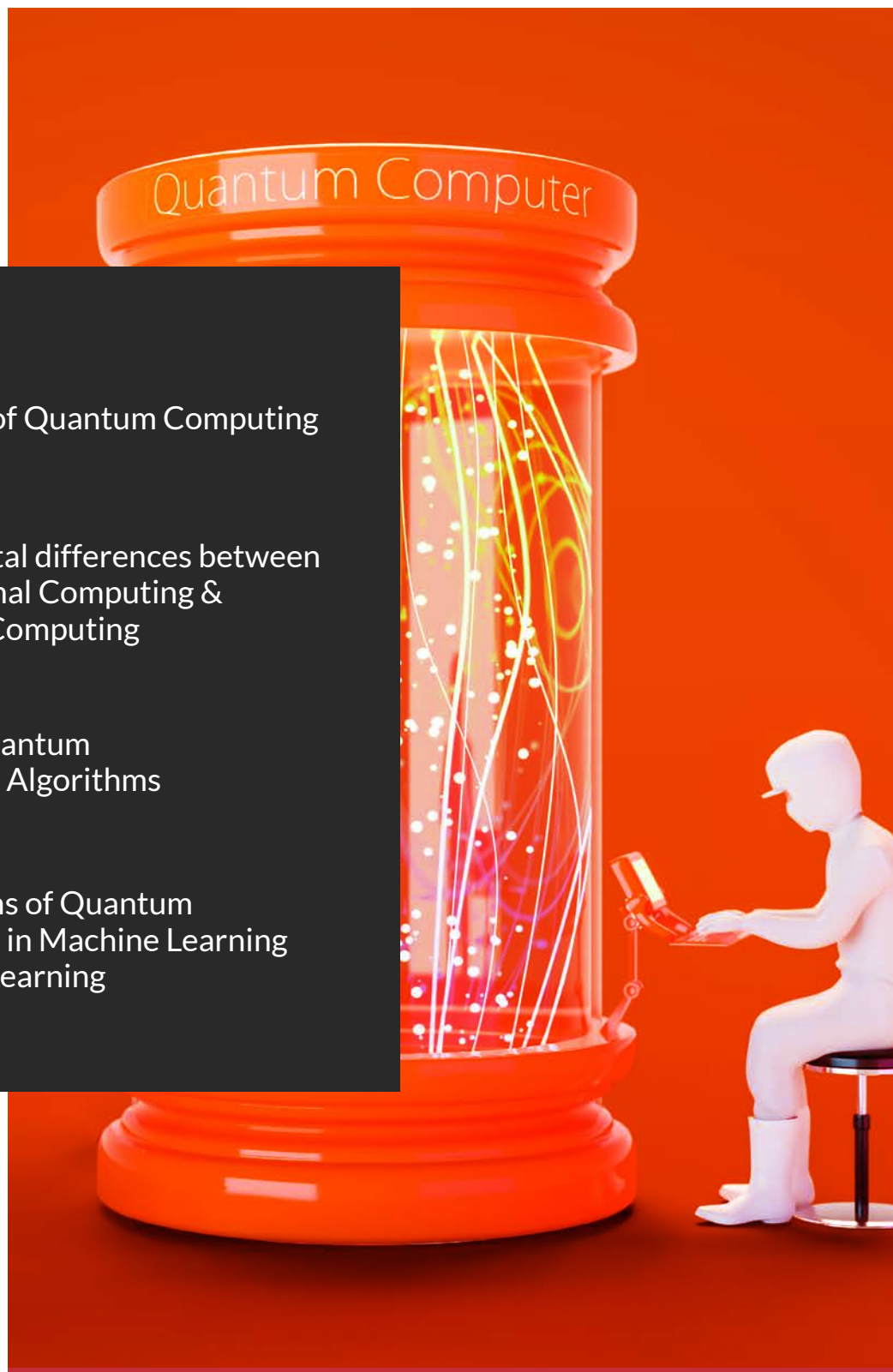
PROGRAMME CONTENT

The programme curriculum comprises the following topics:

Introduction to Quantum Computing

(Quantum Bits, Dirac Notation, Single and Multiple Qubit Gates, No Cloning Theorem, Quantum Teleportation, Quantum Interference)

Postulates of Quantum Computing

(Quantum State, Quantum Evolution, Quantum Measurement, POVM Operators, Density Operators, Hamiltonian Simulation And Trotterization)

Introduction to Quantum Algorithms

(Cirq, Qiskit, Quantum Random Number Generator, Deutsch-Jozsa Algorithm Implementation, Bernstein-Vajirani Algorithm, Bell's Inequality Test, Simon's Algorithm, Grover's Algorithm)

Quantum Fourier Transform and Related Algorithms

(Quantum Fourier Transform, QFT Implementation in Cirq, Quantum Phase Implementation, Quantum Phase Estimation in Cirq, Shor's Period Finding Algorithm and Factoring, Hidden Subgroup Problem)

Quantum Machine Learning

(HHL Algorithm, HHL Algorithm Implementation using Cirq, Quantum Linear Regression, Quantum Swap Test Subroutine, Swap Test Implementation, Quantum Euclidean Distance Calculation, Quantum K-Means Clustering, Quantum Principal Component Analysis, Quantum Support Vector Machines, SVM Implementation using Qiskit)

Quantum Deep Learning

(Hybrid Quantum-Classical Neural Networks, MNIST Classification using Hybrid Quantum-Classification Neural Network, Quantum Neural Network for Classification on Near-Term Processors, MNSIT Classification Using TensorFlow Quantum)

Quantum Variational Optimisation and Adiabatic Methods

(Variational Quantum EigenSolver, Expectation Computation, Isling Model and its Hamiltonian, Isling Model for a Quantum System, Implementation of the VQE Algorithm, Quantum Max-Cut Graph Clustering, Quantum Adiabatic Theorem, Quantum Approximate Optimisation Algorithm, Quantum Random Walk)

PROGRAMME DETAILS

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

Class Schedule
Saturdays:
10:00 a.m. to 11:30 a.m.
Sundays:
10:00 a.m. to 11:30 a.m.

Eligibility
- Any engineering graduate with minimum 50% marks
- Understanding of concepts in linear algebra and probability
- Experience with any programming language

Evaluation
- 60% - Final examination conducted at the end of the programme
- 30% - Projects
- 10% - Attendance

Admission Criteria
Selection based on application

Duration
- 5 Months
- 55 Hours of Learning (45 hours of live sessions & 10 hours of live tutorials/labs sessions)
- 90-Minute Sessions on Weekends

CERTIFICATION*

Candidates who successfully complete the programme and meet the attendance requirements will receive a 'Certificate of Completion' from IIT Delhi.

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

PROGRAMME FACULTY'S PROFILE

Dr. Abhishek Dixit
Assistant Professor,
Dept. of Electrical Engineering, IIT Delhi

Dr. Abhishek Dixit received his M.Tech. degree in Opto-electronics and Optical Communication from Indian Institute of Technology (IIT) Delhi in 2010 and the Ph.D. degree in Computer Science Engineering from Department of Information Technology (INTEC), Ghent University, Belgium, in 2014. Since 2015, he has been an Assistant Professor at IIT Delhi where he has taught courses related to Optical Communications, Signal Processing, Communications Engineering and Networking. Recently, he started actively researching the use of machine learning to improve the performance of communications systems - conventional and quantum. He has also taken an NPTEL course on Principles of Digital Communications.

Before joining IIT Delhi in December 2015, he has served for a semester (July 2015 - December 2015) as an Assistant Professor at IIT Mandi and as a Post-doctoral Researcher (December 2014 - June 2015) at Ghent University, Belgium.

He is leading research activities at IIT Delhi in the area of optical communications and networking. In this context, he has been involved in a large number of Indian projects. He has also carried out several consultation projects in the area of railway signalling.

He has published over 30 international journal articles (IEEE JSAC, IEEE Commun. Mag., Journal of Lightwave Technology, Journal of Optical Communications and Networking, IEEE Networks, IEEE Transactions on Network and Service Management, IEEE Access, IEEE Sensors, IEEE Open Journal of the Commun. Society, etc.) and over 50 publications in international conferences.

Programme Fee

Particulars	Amount (₹)
Programme Fee	125,000
GST@18%	22,500
Total	147,500

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

Instalment Schedule

	Instalment I	Instalment II	Instalment III	Instalment IV
Date	To be paid within 7 days of offer rollout	10th Sept, 2022	10th Oct, 2022	10th Nov, 2022
Amount* (₹)	30,000	30,000	30,000	35,000

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

All invoicing and payment terms, infrastructure, delivery services, and other terms shall be governed as per the agreement/program description sheet

Programme Timelines

Last date to apply	10th May, 2022
Shortlisted candidates will be informed by	18th May, 202
Last date to submit the fee	25th May, 2022
Programme start date	9th July, 2022
Programme end date	December 2022

APPLY NOW

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 College of Engineering in 1961, the Institute was later declared as 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 inception, over 48,000 students have graduated from IIT Delhi in various disciplines including Engineering, Physical Sciences, Management, and Humanities & Social Sciences.

The Department of Management Studies is a result of the evolutionary process of constantly responding to a felt need of the Indian Industry and derives satisfaction from its heavy field orientation in all its curriculum activity. Its programmes are designed keeping in mind the changes in the business environment and are comparable to world-class business school programmes aimed at creating holistic managers to face the challenges of an ever-evolving market ecosystem.

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

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

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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.