

QUANTUM COMPUTING

THE NEXT GENERATION COMPUTING TECHNOLOGY

COURSE BRIEF

Quantum computing is the next generation of computing technology based on quantum mechanics principles. Traditional computers employ bits that can be either '0' or '1' whereas quantum computers use Qubits which can exist in several states at the same time due to superposition and entanglement. This enables quantum computers to perform certain tasks exponentially faster than classical computers. Quantum computing has applications in encryption, drug development, materials research, and other fields. Building stable quantum systems and tackling encryption security concerns are among the challenges. It marks a major advancement in computing with far-reaching consequences for many industries.

The aim of this strategic training programme is to impart basic knowledge of quantum computing to government employees. It will train them to navigate the transformative impact of this next-generation technology. Quantum computing has far-reaching implications for national security, data encryption, innovation, and strategic planning. Government personnel with quantum expertise can contribute to secure communications, informed policy decisions, and harnessing the potential of quantum technology for enhanced disaster preparedness. This training ensures that governments remain at the forefront of technological advancements and can effectively address the challenges and opportunities presented by quantum computing in the public sector.

COURSE OBJECTIVE

- To impart basic knowledge about quantum computing and its use cases/application, quantum mechanics & linear algebra.
- To impart a basic understanding of quantum bits, quantum logic gates, quantum algorithms, introduction to quantum circuit simulator and python-based software environment.
- To provide a structured forum for peer-to-peer interaction and knowledge sharing among the scientific community for better networking and synergy.

METHODOLOGY

The content will be delivered through lectures/presentations as well as interactive sessions. Apart from C-DAC faculty, distinguished Guest speakers would include eminent experts from Academia, the Scientific community, and government organisations.

TARGET GROUP

The scientists/ Technologist (Group-A only) holding scientific posts/ working in Scientific Ministries/ Departments of Govt. of India and State Governments, Autonomous Institutions/ Public Sector Undertakings of Central/ State Governments, Research and Development Institutions/ Research Laboratories of Central / State Governments, Central/ State Universities, State Science & Technology Councils. The Scientists and Academicians (only Ph.D./ M.Tech Degree holders) from Central and State Universities, Educational Institutions and colleges, engaged in R&D in any discipline of Science and technology are also eligible.

- Group 'A' officer serving in Govt. organization.
- The upper age limit is 58 years on July 1, 2023.
- Number of years of service as Group 'A' scientist- 05 years and above.
- The nominations shall be accepted as per DST guidelines.

VENUE OF TRAINING

The two-week residential training programme is planned to take place at the Centre for Development of Advanced Computing (C-DAC) in Mohali, Punjab.

BOARDING AND LODGING

- Participants will be provided with Hotel or Guest House accommodation during the training period.
- Participants are responsible for any overstay expenses incurred before or after the training period, as well as any costs associated with their personal visits.

BATCH SIZE

The programme has a limited intake capacity of 25 participants, and their admission will be based on the criteria outlined in the Training Guidelines set by the Department of Science and Technology (DST), Government of India.

FEE / SPONSORSHIP

The programme is sponsored by the Department of Science and Technology (Government of India), and participants will not receive any Travel Allowance (TA) or Daily Allowance (DA). However, all expenses related to the training program, including Fees, Food, Accommodation, and Local Transportation, will be covered by the DST, Gol, except for the costs of the participants' travel from their place of duty to C-DAC, which will be borne by the sponsoring organizations.

TRAINING SESSION PLAN

Four Sessions per day 08th -19th January, 2024

- DAY-1. Introduction to Quantum Computing, History of Quantum Computation.
- DAY-2. Applications & Use Cases, Quantum Vs. Classical Computing, Quantum Initiatives & Resources.
- DAY-3. Superposition & Entanglement principles, Qubit Technologies.
- DAY-4. Exposure to Circuit Composer, Quantum Information Science Kit (QISKIT), and Quantum Simulator (QSIM) Toolkit.
- DAY-5. Quantum Mechanics & Linear Algebra, Linear operators and matrices, Pauli matrices, Inner products, Tensor products.
- DAY-6. A brief introduction to Python Programming, Features, and Installation.
- DAY-7. Single/Multiple Qubit Gates, Quantum Circuits, Bell States.
- DAY-8. Quantum Teleportation, Super Dense Coding.
- DAY-9. Quantum Algorithms: Quantum Fourier Transform, Grover's algorithm.
- DAY-10. Implementations of Quantum Fourier Transform and Grover's algorithm.

Internal Resource Persons w.r.t training:

- Sh. V.K. Sharma (Centre Head)
- Sh. Ajay Mudgil (Joint Director & Nodal Officer)
- Dr. Gurmohan Singh (Joint Director)
- Dr. Manjit Kaur (Joint Director & Training/Program Coordinator)
- Sh. Vivek Nainwal (Joint Director)
- Smt. Amritpal Kaur (Senior Technical Officer)
- Smt. Nandita Singla (Project Engineer)

Eminent speakers from Academia, the Scientific community Government Organizations and industry may be imparting knowledge by sharing their experiences as per their availability.

How to Apply

The nominated officers should register and apply online for this training programme at the DST's training portal i.e. <https://training.dst.gov.in> and follow the instructions/steps contained therein.

For any further details, applicants can also contact:

Ajay Mudgil (Nodal Officer-DST Trainings)
C-DAC, A-34, Industrial area, Phase-8, Mohali-160071
Ph. No- 0172-6619000, 2237052-55
Email ID: ajay@cdac.in, dst-trg@cdac.in

ABOUT C-DAC

Centre for Development of Advanced Computing (C-DAC) is the premier R&D organization of the Ministry of Electronics and Information Technology (MeitY) for carrying out R&D in IT, Electronics and associated areas. C-DAC has today emerged as a premier R&D organization in IT&E (Information Technologies and Electronics) in the country working on strengthening national technological capabilities in the context of global developments in the field and responding to change in the market need in selected foundation areas.

As an institution for high-end Research and development (R&D), C-DAC has been at the forefront of the Information Technology (IT) revolution, constantly building capacities in emerging/enabling technologies and innovating and leveraging its expertise, calibre, skill sets to develop and deploy IT products and solutions for different sectors of the economy, as per the mandate of its parent, the Ministry of Electronics and Information Technology, Ministry of Communications and Information Technology, Government of India and other stakeholders including funding agencies, collaborators, users and the market-place.

C-DAC, Mohali operates from its own impressive building having a covered area of approximately 4300 sq. mts. The centre is engaged in the design and deployment of world-class IT and electronics solutions in the following domains:

- Health Informatics
- Quantum Computing
- Artificial Intelligence
- Software Technologies
- Multilingual Technologies
- Cyber Forensics and Security
- Augmented & Virtual Reality



Centre continues to play a leading role in human resource development and training in Information Technology (IT) and electronics sector in the northern region. From year 2020, C-DAC Mohali is also conducting M. Tech in (VLSI Design), M.Tech in CSE (Artificial Intelligence), M.Tech in CSE (Cyber Security) and M.Tech in Embedded Systems. Short-term value-added courses and diplomas are designed for knowledge-based skill development. It also offers courses for foreign participants, sponsored by MEA under ITEC/SCAAP programs. The Centre is certified for ISO 9001:2015 standard.

FACILITIES

Library

The Library has a well-rounded collection of books and Periodicals/ Journals. These include textbooks, foundation books and books for subsidiary readings. The institute has access to digital library resources also.

Labs

There are many labs under different divisions for example: iOS MAC Lab, Embedded Systems Lab, VLSI Design Lab, Telemedicine, Cyber Security, Advance Network Engineering Lab, FOSS Lab, Multilingual Lab, Multi-Media & Web Design, IT For Masses Lab, Workshops etc. These Labs are equipped with PCs, Servers (i3 / i5 / i7 Latest Configuration), IT hardware, and Software and each system is connected to a LAN. Classrooms are equipped with LCD projector.

Auditorium & Conference Room

The Centre has an AC Auditorium with capacity to accommodate 100+ persons. The auditorium is fitted with audio-visual equipment. The conference room has a capacity to accommodate 30 persons.

Quantum Computing

The Next Generation Computing Technology

for
Scientists and Technologists
working in Government Sector

08th - 19th January 2024

Sponsored by
Department of Science & Technology,
Govt. of India, New Delhi



Organised by
Centre for Development of Advanced Computing (C-DAC)
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