

&  
**Electronics & ICT Academy**  
IIT Roorkee



presents

**Online Short Course/FDP**

on

**Practical Quantum Computing  
using Qiskit and IBMQ**

**September 12-October 04, 2020  
(Weekends only)**

**At par with QIP for  
recognitions/credits**

**Expert from Academia**  
**Prof. Sugata Gangopadhyay,**  
**CSE Deptt., IIT Roorkee**

**Supported by**

Ministry of Electronics & Information Technology  
Government of India

**Certificates to participants by  
E&ICT Academy IIT Roorkee**



**Classes will be delivered on  
weekends through online platform**

**Why Quantum Computing?**

Quantum computing has the potential to revolutionise the way we think about computing and information processing. The first batch of quantum algorithms have shown that quantum computers can outperform classical computers in certain specialised tasks. New applications are being proposed in a variety of fields. This course will introduce you to the basics of quantum computing through a practical approach. Participants will learn about qubits and gating operations, construct quantum circuits and learn about quantum algorithms. Participants will also learn how to use Qiskit to construct and run quantum circuits on simulators and actual quantum hardware using Python.

**Course Objectives**

- Introduction to basics of quantum computing, quantum circuits and applications of quantum algorithms.
- Introduction to Python programming for quantum hardware using Qiskit.

**Benefits and Outcomes of the Course**

- Learn about qubits and quantum circuits.
- Learn how to represent qubits and perform gating operations on them.
- Construct quantum circuits and run them on actual quantum hardware.
- Learn about quantum communication protocols and QKD, with important applications in security and cryptography.

**Registration Link**

<http://tiny.cc/wvvozs>

**Focus Areas**

- Introduction to the qubit, Dirac notation.
- Review of linear algebra and complex numbers.
- Single qubit operations, fundamental gates.
- Notion of quantum measurement.
- Multi-qubit states and operations, quantum entanglement.
- Elements of quantum circuits
- Quantum parallelism, quantum teleportation
- Quantum Key Distribution protocols, BB84
- Quantum Algorithms: Deutsch's Algorithm

**Programme Features**

- The program will consist of lectures and labs/hands-on sessions.
- Hands-on experience on Qiskit programming.
- Interaction & learning with leading researchers from academia.
- Certificates to participants by E&ICT Academy IIT Roorkee.

**Course Fees**

There are no fees to attend this course.

**Who Can Attend ?**

Program is open to faculty members/ PhD research scholars and students from academic and research institutions.

**Principal Investigator**

**Prof. Sanjeev Manhas**  
CSE Deptt., IIT Roorkee

**Course Coordinator**

**Prof. Sugata Gangopadhyay**  
CSE Deptt., IIT Roorkee

**Contact Details**

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This Online Short Course/FDP is being organised as part of the research project  
**“Design and Development of Quantum computing Toolkit (Simulator, Workbench) and Capacity Building”**

sponsored by

Ministry of Electronics & Information Technology,  
Government of India

**Principal Investigator**

Prof. Sugata Gangopadhyay, PI,  
CSE Dept., IIT Roorkee

**About the Project**

The objective of the project is to develop a Quantum Computing Toolkit as a first step to build expertise in quantum computing in the nation. This is a joint collaborative effort by C-DAC, IISc and IIT Roorkee bringing together their expertise to make this project a success. This toolkit will be used in core quantum computing research to develop new algorithms as well as applications of quantum computing in other fields. In addition to this, several training programs and courses will also be organised for the dissemination of knowledge in the field of quantum computing as well as training for the toolkit.

**EICT Academy, IIT Roorkee**

Electronics and ICT Academy (E&ICT) at IIT Roorkee (funded by Ministry of Electronics and Information Technology) aims to enrich and upgrade teaching and research competencies of engineering faculties of institutes/colleges by conducting courses and workshops in fundamentals as well as emerging areas of E&ICT and enabled areas. The programs are conducted by well-known industry partners, resource persons from leading academia and experts from renowned R&D organizations.



**Activities of the Academy**

- Specialized training on basic and advanced level topics with hands-on experience in the emerging areas of Electronics & ICT.
- Setup the activity centers to conduct short courses/FDPs locally at institutes/colleges.
- Curriculum development for the industry.
- Continuing Education Programme for students/working professionals.
- Design, develop and delivery of specialized modules for specific research areas in industry.

**Online Short Course/FDP**

on

**Practical Quantum Computing using Qiskit and IBMQ**

Dates: 12 Sep – 4 Oct 2020  
(Weekends)



**REGISTRATION FORM**

Applicant Name \_\_\_\_\_

Gender: \_\_\_\_\_

Category (GEN/OBC/SC/ST): \_\_\_\_\_

Designation: \_\_\_\_\_

Name and Address of the Organization/Institute: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

City/Town: \_\_\_\_\_

Email: \_\_\_\_\_

Phone Number: \_\_\_\_\_

**Signature of the Applicant**

**Contact Us**

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**Important Dates**

**Last Date For Registration :  
10 September 2020**

