



LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(An Autonomous Institution since 2010)

Accredited by NAAC with 'A' Grade & NBA (Under Tier - I),
An ISO 21001:2018, 14001:2015, 50001:2018 Certified Institution

Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Mapping of FDP Outcomes with Sustainable Development Goals (SDGs)

The FDP on “Foundations of Quantum Information Processing” contributes primarily to SDG 4, SDG 9, and SDG 17, with indirect relevance to SDG 8.

FDP Outcomes	SDG 4 Quality Education	SDG 8 Decent Work & Economic Growth	SDG 9 Industry, Innovation & Infrastructure	SDG 17 Partnerships for the Goals
FDP-CO1: Understand the fundamental concepts of Quantum Computing and Quantum Information Processing.	✓		✓	
FDP-CO2: Develop understanding of qubits, quantum gates, circuits, entanglement, and quantum interference.	✓		✓	
FDP-CO3: Analyze fundamental quantum information concepts and their significance in emerging technologies.	✓	✓	✓	
FDP-CO4: Apply the acquired knowledge for teaching, learning, and exploring research opportunities in quantum technologies.	✓	✓	✓	✓


Dr. S. Nagarjuna Reddy

Head of the Department

Department of Computer Science & Engineering
Lakireddy Balireddy College of Engineering
MYLAVARAM-521 230, A.P. INDIA



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Mapping of FDP Outcomes with Program Outcomes (POs) and PSOs

The outcomes of the FDP on “Foundations of Quantum Information Processing” can be mapped with Program Outcomes (POs) as follows:

FDP Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
FDP-CO1: Understand the fundamental concepts of Quantum Computing and Quantum Information Processing.	3											2		2	
FDP-CO2: Develop understanding of qubits, quantum gates, circuits, entanglement, and quantum interference.	3	2	2									2		2	
FDP-CO3: Analyze the principles and significance of quantum information concepts such as the No-Cloning Theorem and entanglement.	2	3		2								2		2	
FDP-CO4: Apply the acquired knowledge for teaching, learning, and exploring research opportunities in quantum technologies.	2	2	2	3	2					2	2	3	1	2	

Dr. S. Nagarjuna Reddy

Head of the Department

HEAD

Department of Computer Science & Engineering
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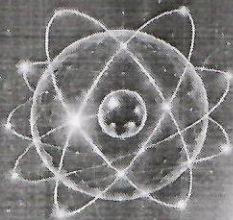
Organises

A Five Day Online Faculty Development Program
on

FOUNDATIONS OF QUANTUM INFORMATION PROCESSING

Sponsored by
Council for Skills and Competencies (CSC India)

"Think Beyond
The Classical"



$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$$



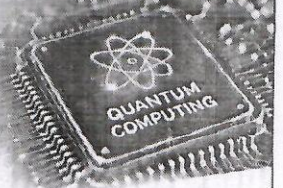
Welcome

to All Participants

Let's Explore the Quantum World Together...!



"Small Ideas
Can Create a
Brighter Tomorrow"



21st - 26th
September 2026



6:30 PM - 7:30 PM
(IST)



Mode
Online



TECHNOLOGY
PEOPLE
PROGRESS
TOGETHER

BUILDING THE NEXT GENERATION THROUGH KNOWLEDGE AND SKILLS



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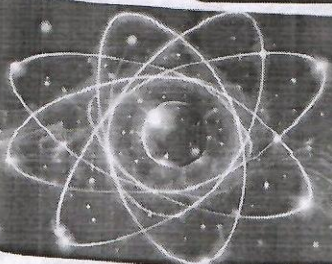
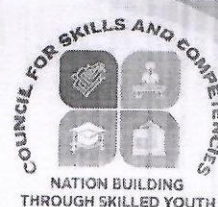
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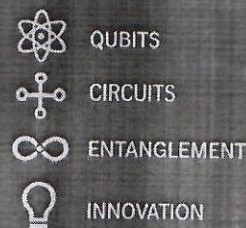
A Five Day Online Faculty Development Program
on

FOUNDATIONS OF QUANTUM INFORMATION PROCESSING

in association with CSC India
(Council for Skills and Competencies).



QUANTUM TECHNOLOGIES
SHAPE A BRIGHTER FUTURE



Resource Person



Dr. Anirban Bhattacharjee

Assistant Professor

Department of Computer Science
Engineering

Sardar Vallabhbhai National Institute of
Technology (SVNIT), Surat, Gujarat



DAY-WISE TOPICS

Day 1

Motivation and How
Quantum Computing Differs
from Classical Computing



Day 2

Mathematical Background
and Qubits



Day 3

Quantum Gates
and Circuits



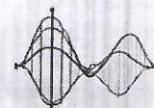
Day 4

Entanglement



Day 5

No-Cloning Theorem
and Interference



LEARN



COLLABORATE

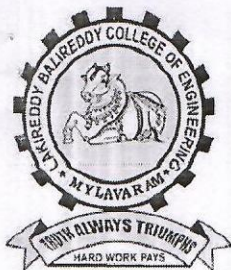


INNOVATE



GROW

Together
Towards a Brighter Tomorrow



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

FDP REPORT ON FOUNDATIONS OF QUANTUM INFORMATION PROCESSING

Event Type	: One week FDP
Dates	: 21 – 26, Sep 2026
Time	: 06:30 PM - 07:30 PM
Mode	: Online
Organized by	: Organized by Department of CSE, LBRCE.
In Collaboration with	: CSC India – Council for Skills and Competencies
Resource Speaker	: Dr. Anirban Bhattacharjee, Assistant Professor, Department of Computer Science and Engineering, Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat, Gujarat.
Conveners	: Dr. S. Nagarjuna Reddy, Professor & Head, CSE
Co-Convenor	: Mr. Y. Rammohana Rao, Associate Director, CSC India
Coordinator(s)	: Dr. K. Devi Priya, Professor, CSE Mr. S. Srinivasa Reddy, Sr. Asst. Professor, CSE Mr. D. Anil Kumar, Sr. Asst. Professor, CSE
Organizing Committee	: Dr. D. Veeraiah, Professor Dr. Y. V. Bhaskar Reddy, Professor Ms. B. Swathi, Sr. Assistant Professor Ms. P. Sarala, Sr. Assistant Professor Mr. N. Srikanth, Sr. Assistant Professor Mrs. B. Nirosha, Assistant Professor
Target Audience	: All the teaching faculty
Total no. of faculty	: 529

Introduction

The Faculty Development Program (FDP) on “Foundations of Quantum Information Processing” was organized to enhance the conceptual and technical understanding of faculty members in the emerging field of **Quantum Computing and Quantum Information Processing**. The five-day program brought together academic professionals and faculty members to explore the fundamental principles of quantum computing, including **classical versus quantum computing, mathematical foundations, qubits, quantum gates, quantum circuits, entanglement, the No-Cloning Theorem, and quantum interference**.

The FDP provided a systematic progression from the **fundamental concepts of quantum information to the core principles underlying quantum computation**. The sessions combined theoretical explanations, mathematical representations, conceptual examples, and interactive discussions to help participants develop a strong foundation in this rapidly evolving domain. The program also highlighted the relevance of quantum technologies in future computing, communication, information processing, and research applications.

The FDP was conducted with the valuable contribution of **Dr. Anirban Bhattacharjee, Assistant Professor, Department of Computer Science and Engineering, Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat**, who shared his expertise and insights on the fundamental aspects of Quantum Information Processing. The program was organized by the **Department of Computer Science and Engineering, Lakireddy Bali Reddy College of Engineering (Autonomous), Mylavaram**, in collaboration with **CSC India (Council for Skills and Competencies)**.

Objective of the Event

The FDP was organized with the following key objectives:

1. **Introduce the fundamentals of Quantum Computing and Quantum Information Processing.**
2. **Explain the differences between classical and quantum computing**, including the role of qubits and superposition.
3. **Develop understanding of basic quantum concepts**, including quantum states, gates, circuits, and entanglement.
4. **Explain the No-Cloning Theorem and Quantum Interference** and their significance in quantum information processing.
5. **Provide a foundation for future learning, teaching, and research** in quantum computing and related technologies.

DAY 1

Topic: Motivation and How Quantum Computing Differs from Classical Computing

Session Overview:

The first day of the FDP focused on establishing a conceptual foundation for understanding **Quantum Computing**. The session began with the motivation behind the emergence of quantum computing and discussed why conventional classical computing approaches may face limitations for certain computational problems.

Major Topics Covered

- Introduction to Quantum Computing
- Motivation for Quantum Computing
- Evolution of computing technologies
- Classical Computing fundamentals
- Quantum Computing fundamentals
- Classical bits versus quantum bits
- Comparison between classical and quantum computing
- Quantum superposition – introductory concept

- Potential applications of Quantum Computing
- Importance of Quantum Information Processing

Key Learning Outcomes

At the end of Day 1, participants were able to:

1. Explain the motivation behind the development of Quantum Computing.
2. Differentiate between classical and quantum computing paradigms.
3. Understand the basic principles underlying quantum information.
4. Identify potential applications of quantum technologies.
5. Recognize the importance of learning quantum concepts for emerging computing applications.

Participant Engagement

The session encouraged participants to compare conventional computational models with quantum computational principles. Interactive explanations and conceptual examples helped participants develop an initial understanding of the quantum computing paradigm.

Day 1 Outcome

The session successfully established the **conceptual foundation required for understanding subsequent topics in Quantum Information Processing.**

DAY 2

Topic: Mathematical Background and Qubits

Session Overview

Day 2 focused on the **mathematical foundations of Quantum Computing** and introduced **Qubits**, which form the fundamental unit of quantum information.

The session connected mathematical concepts with their application in representing and manipulating quantum states.

Major Topics Covered

- Mathematical foundations of Quantum Computing
- Representation of quantum states
- Basic concepts required for quantum information
- Introduction to Qubits
- Classical bit versus Qubit
- Quantum state representation
- Superposition of quantum states
- Probability amplitudes
- Measurement of quantum states
- Bloch-sphere representation – introductory understanding

Key Learning Outcomes

Participants were able to:

1. Understand the mathematical concepts required for Quantum Computing.

2. Explain the concept of a Qubit.
3. Differentiate between a classical bit and a Qubit.
4. Understand the representation of quantum states.
5. Explain the concept of quantum superposition.
6. Understand the role of measurement in quantum systems.

Participant Engagement

The mathematical concepts were presented progressively, allowing participants with different levels of prior exposure to quantum computing to follow the session. Examples related to Qubits helped participants connect mathematical representations with physical interpretations.

Day 2 Outcome

The session provided participants with a **strong mathematical and conceptual foundation for understanding quantum states and quantum computation.**

DAY 3:

Topic: Quantum Gates and Circuits

Session Overview

Day 3 introduced participants to the fundamental building blocks used for performing operations on Qubits—**Quantum Gates and Quantum Circuits.**

The session explained how quantum information can be manipulated using quantum operations and how individual gates can be combined to construct quantum circuits.

Major Topics Covered

- Introduction to Quantum Gates
- Single-Qubit operations
- Quantum gate representation
- Pauli gates
- Hadamard gate
- Phase-related operations
- Multi-Qubit operations
- Quantum Circuit representation
- Sequential application of quantum gates
- Relationship between Qubits, Gates and Circuits
- Basic quantum circuit examples

Key Learning Outcomes

Participants were able to:

1. Explain the purpose of Quantum Gates.
2. Understand basic single-Qubit gates.
3. Explain the role of the Hadamard gate in creating superposition.
4. Understand the structure of quantum circuits.
5. Explain how quantum gates are combined to perform computations.
6. Interpret basic quantum circuit representations.

Participant Engagement

The use of quantum circuit representations and examples helped participants understand how abstract quantum principles can be translated into computational operations.

Day 3 Outcome

The session enabled participants to move from the **theoretical understanding of Qubits to the operational aspects of quantum computation.**

DAY 4:

Topic: Entanglement

Session Overview

Day 4 focused on one of the most important and distinctive phenomena in Quantum Information Processing—**Quantum Entanglement.**

The session explained how quantum states can become correlated in ways that have no direct classical counterpart and discussed the importance of entanglement in quantum technologies.

Major Topics Covered

- Introduction to Quantum Entanglement
- Concept of entangled states
- Correlation between quantum particles
- Entangled Qubits
- Quantum states and measurement
- Importance of entanglement
- Entanglement in Quantum Information Processing
- Applications of entanglement
- Role of entanglement in quantum communication
- Conceptual examples of entangled states

Key Learning Outcomes

Participants were able to:

1. Define Quantum Entanglement.
2. Explain the basic characteristics of entangled states.
3. Understand correlations between entangled Qubits.
4. Recognize the importance of entanglement in quantum technologies.
5. Identify applications of entanglement in quantum communication and information processing.

Participant Engagement

The session used conceptual explanations and examples to help participants understand the often challenging phenomenon of quantum entanglement.

Day 4 Outcome

The session provided participants with an understanding of **entanglement as a fundamental resource in Quantum Information Processing**.

DAY 5:

Topic: No-Cloning Theorem and Interference

Session Overview

The final technical session of the FDP addressed two important concepts in Quantum Information Processing: the **No-Cloning Theorem** and **Quantum Interference**.

The session also helped participants connect the concepts covered throughout the five-day programme.

Major Topics Covered

- Introduction to the No-Cloning Theorem
- Principle of quantum state cloning
- Why an unknown quantum state cannot be perfectly copied
- Significance of the No-Cloning Theorem
- Quantum Interference
- Constructive interference
- Destructive interference
- Role of interference in quantum computation
- Relationship between superposition and interference
- Applications in quantum algorithms

Key Learning Outcomes

Participants were able to:

1. Explain the No-Cloning Theorem.
2. Understand why arbitrary unknown quantum states cannot be perfectly copied.
3. Explain the concept of Quantum Interference.
4. Differentiate constructive and destructive interference.
5. Understand the role of interference in quantum computation.
6. Relate the concepts of Qubits, Gates, Superposition, Entanglement and Interference.

Participant Engagement

The final session provided an opportunity for participants to consolidate the concepts learned throughout the FDP and understand how fundamental quantum principles contribute to quantum computation.

Day 5 Outcome

The session provided a meaningful conclusion to the technical component of the FDP by connecting **quantum states, quantum operations and fundamental quantum phenomena**.

Overall Learning Outcomes of the FDP

After completion of the five-day FDP, participants gained an introductory understanding of:

- Fundamentals of Quantum Computing
- Classical versus Quantum Computing
- Mathematical foundations of Quantum Information
- Qubits and quantum states
- Quantum Superposition
- Quantum Gates
- Quantum Circuits
- Quantum Entanglement
- No-Cloning Theorem
- Quantum Interference
- Applications of Quantum Information Processing

Participant Feedback

Daily feedback was collected from participants to assess the effectiveness of each session.

The feedback focused on:

- Quality and relevance of technical content
- Clarity of explanation
- Effectiveness of the resource person
- Quality of examples and illustrations
- Interaction and engagement
- Pace of the session
- Achievement of learning objectives
- Overall usefulness of the session

Participants were also provided opportunities to share their **key learning outcomes, suggestions, and areas requiring further explanation.**

Suggestions

1. Conduct **advanced FDPs and workshops** on quantum algorithms and quantum programming.
2. Provide **hands-on sessions using quantum computing platforms and simulators.**
3. Encourage faculty members to undertake **research projects and interdisciplinary work** in quantum technologies.
4. Introduce **quantum computing concepts into relevant academic courses and laboratory activities.**
5. Organize **regular seminars, expert lectures, and follow-up training programs** to support continuous learning in this emerging field.

Overall FDP Outcome

The Five-Day FDP provided participants with a structured introduction to the fundamental principles of **Quantum Information Processing**. The programme progressed systematically from the motivation and basic concepts of quantum computing to mathematical foundations, Qubits, quantum operations, entanglement, the No-Cloning Theorem and interference.

The programme helped participants develop the conceptual foundation necessary for further learning in areas such as:

- Quantum Algorithms
- Quantum Programming
- Quantum Cryptography

- Quantum Communication
- Quantum Machine Learning
- Quantum Information Theory

Impact Analysis

The Faculty Development Program on “**Foundations of Quantum Information Processing**” enhanced the participants’ conceptual understanding of emerging quantum technologies. The systematic coverage of qubits, quantum gates, circuits, entanglement, the No-Cloning Theorem, and interference helped participants develop a strong foundation in Quantum Information Processing. The program also encouraged faculty members to explore the integration of quantum computing concepts into teaching, academic activities, and future research. The interactive sessions and expert guidance provided greater awareness of the potential applications and future scope of quantum technologies.

Conclusion

The five-day Faculty Development Program on “**Foundations of Quantum Information Processing**” provided participants with a structured understanding of the fundamental concepts of quantum computing and quantum information processing. The program covered key topics including **classical and quantum computing, mathematical foundations, qubits, quantum gates and circuits, entanglement, the No-Cloning Theorem, and quantum interference.**

The FDP strengthened participants’ conceptual knowledge and created awareness of the emerging applications and research opportunities in quantum technologies. Overall, the program provided a strong foundation for further learning, teaching, and research in **Quantum Computing and Quantum Information Processing.**

Acknowledgement

The Department of Computer Science and Engineering, **Lakireddy Bali Reddy College of Engineering (Autonomous)**, sincerely acknowledges the valuable contribution of **Dr. Anirban Bhattacharjee, Assistant Professor, Department of Computer Science and Engineering, SVNIT, Surat**, for delivering the technical sessions and sharing his expertise and insights with the participants.

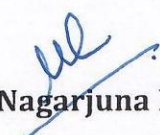
The department also expresses its gratitude to **CSC India – Council for Skills and Competencies** for the collaboration and support extended towards conducting the Faculty Development Programme.

Coordinators:

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Mr. D. Anil Kumar, Sr. Asst. Professor, CSE


Dr. S. Nagarjuna Reddy

Convener of FDP

Professor & Head, CSE

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