Course Title: **Quantum Cryptography**

Credit Hours: 3

Prerequisites: Basic knowledge of cryptography and quantum mechanics

Course Description:

This course explores the principles and protocols of secure communication using quantum mechanics, including quantum key distribution (QKD), BB84 and E91 protocols, and quantum random number generation. Students will study the security proofs based on fundamental quantum principles such as no-cloning theorem and uncertainty relations, analyze practical implementations, and examine quantum-resistant cryptographic schemes. The course covers both theoretical foundations and real-world applications of quantum cryptography in securing communication networks against classical and quantum attacks.

Course Objectives:

1. Understand principles of quantum cryptography and security protocols
2. Master quantum key distribution mechanisms
3. Analyze security threats in quantum communication systems

Course Learning Outcomes: Students will be able to:

1. Design and analyze quantum key distribution protocols
2. Implement quantum security protocols and authentication methods
3. Evaluate security vulnerabilities in quantum systems
4. Develop post-quantum cryptographic solutions

Course Contents:

Week	Contents
1-2	Classical vs quantum cryptography fundamentals
3-4	Quantum key distribution (BB84, B92 protocols)
5-6	Quantum random number generation
7-8	Quantum digital signatures and authentication
9-10	Security analysis and eavesdropping detection
11-12	Post-quantum cryptography

13-14 Quantum secure direct communication

15-16 Implementation challenges and practical systems

Textbooks/ References:

- Sakurai & Napolitano – Modern Quantum Mechanics
- Nielsen & Chuang – Quantum Computation and Quantum Information
- Griffiths & Schroeter – Introduction to Quantum Mechanics

1. Gisin, N. & Thew, R. "Quantum Communication" (2020)
2. Chen, L. & Jordan, S. "Report on Post-Quantum Cryptography" NIST (2019)

Assessment:

1. Assignments: 10%
2. Quizzes: 10%
3. Midterm Exam: 30%
4. Final Exam: 50%