Introduction to Quantum Computing
PHY 3100-01
Fall 2026

Instructional Materials: Calculator and paper or a notebook
Required Textbook: Quantum Computing: From Alice to Bob (Oxford Academic)

Course description: Basic concepts underlying quantum information science and quantum computing are introduced and discussed. Topics include quantum state vector notation, quantum states and operations, qubits, entanglement, quantum gates and circuits, and quantum algorithms. Implementations of quantum computers will also be briefly discussed.

Course learning outcomes:

Course learning outcomes	*Corresponding UNI learning outcomes*
Basic concepts underlying quantum information science and quantum computing are introduced and discussed. Topics include quantum state vector notation, quantum states and operations, qubits, entanglement, quantum gates and circuits, and quantum algorithms. Implementations of quantum computers will also be briefly discussed.	Program Content Knowledge, critical thinking skills

Grades

Homework: At this stage in your career, working in a group on homework is expected and encouraged. I expect you to only turn in homework that you understand. If you do not understand something you should ask me, a classmate, another professor, or the internet. Never copy, **especially** without understanding. Do not abuse this policy as homework is a crucial part of this course. Homework should be turned in by 5:00 pm on the due date. Late homework will result in loss of points

Exam: Two exams will be administered during the semester. At least one-week notice will be given prior to the exam.

Report: You will have to complete a report on the topic of your choice related to material covered in class. Please confirm your project with your instructor before beginning. You should begin this project after the second exam.

Final Grade: Homework 20%
Exams (2) 60%
Report (1) 20%

A 100-93.0	**A-** 93.0-90.0	**B+** 90.0-87.0
B 87.0-83.0	**B-** 83.0-80.0	**C+** 80.0-77.0
C 77.0-73.0	**C-** 73.0-70.0	**D+** 70.0-67.0
D 67.0 - 63.0	**D-** 63.0-60.0	**F** below 60.0

Schedule (Very Tentative)

Week	Day		Topic	Notes
1	Mon	24-Aug	Vectors, bases, and complex numbers	**HW#1**
	Wed	26-Aug	Vectors and matrix operations	
	Fri	28-Aug	Vector normalization and wave interference	
2	Mon	31-Aug	Background in quantum mechanics, Dirac notation	
	Wed	2-Sept	**Review Day**	
	Fri	4-Sept	Traditional binary logic	**(HW#1 due) HW#2**
3	Mon	7-Sept	**University Holiday**	
	Wed	9-Sept	Adding in binary	
	Fri	11-Sept	Quantum computing logic	
4	Mon	14-Sept	Qbits and quantum states	
	Wed	16-Sept	**Review Day**	
	Fri	18-Sept	Beam splitters	**(HW#2 due) HW#3**
5	Mon	21-Sept	Quantum Measurements	
	Wed	23-Sept	Quantum gates and circuits	
	Fri	25-Sept	Concept of quantum spin	
6	Mon	28-Sept	Hadamard Gate	
	Wed	30-Sept	Successive quantum gates	

	Fri	2-Oct	**Review for Exam**	
7	Mon	5-Oct	**Exam 1**	**(HW#3 due) HW#4**
	Wed	7-Oct	Quantum spin systems #1	
	Fri	8-Oct	Bennet-Brassard-84 Encryption #1	
8	Mon	12-Oct	Bennet-Brassard-84 Encryption #2	
	Wed	14-Oct	Multi-Qbit systems	
	Fri	16-Oct	Quantum entanglement	
9	Mon	19-Oct	Quantum entanglement	
	Wed	21-Oct	**Review Day**	
	Fri	23-Oct	Changing basis for a 2 Qbit state	**(HW#4 due) HW#5**
10	Mon	26-Oct	2 Qbits with 3 measurements #1	
	Wed	28-Oct	2 Qbits with 3 measurements #1	
	Fri	30-Oct	Quantum circuits: multiple Qbits	
11	Mon	2-Nov	The Bell circuit	
	Wed	4-Nov	The Bell circuit with matrices	
	Fri	6-Nov	Entanglement swapping	
12	Mon	9-Nov	**Review for Exam**	
	Wed	11-Nov	**Exam 2**	**(HW#5 due) Final Projects**
	Fri	13-Nov	Deutsch algorithm #1	
13	Mon	16-Nov	Deutsch algorithm #2	
	Wed	18-Nov	Grover's algorithm #1	
	Fri	20-Nov	Grover's algorithm #2	
14	Mon	23-Nov	**Thanksgiving Break**	
	Wed	25-Nov		
	Fri	27-Nov		
15	Mon	30-Nov	**Independent Study: Individual Meetings**	
	Wed	2-Dec		
	Fri	4-Dec		
16	Mon	7-Dec		
	Wed	9-Dec		
	Fri	11-Dec		
17	Mon	17-Dec	***Report due***	8:00 - 9:50 a.m.