

# OSE6347: Quantum (Spring 2024)

## Grading

30% midterm; 40% final; 30% homework

## Suggested textbooks

M. O. Scully and M. S. Zubairy, "Quantum Optics"

P. Lambropoulos and D. Petrosyan, "Fundamentals of Quantum Optics and Quantum Information"

W. H. Louisell, "Quantum Statistical Properties of Radiation"

### **Week 1:**

Introduction; review of quantum mechanics

### **Week 2:**

Quantum harmonic oscillator; Quantization of the optical field

### **Week 3:**

Single-photon states I: Interferometry

### **Week 4:**

Single-photon states II: Applications, quantum cryptography (BB84)

### **Week 5:**

Two-photon states I: Entanglement

### **Week 6:**

Two-photon states II: Bell's inequality

### **Week 7:**

Two-photon states III: Applications, quantum communications (cryptography, dense-coding, teleportation)

### **Week 8:**

Two-photon states IV: Spontaneous parametric down-conversion

### **Week 9:**

GHZ states, Quantum coherence, Glauber coherent states

### **Week 10:**

Light-matter interactions, semiclassical treatment I: Refractive index, optical nonlinearities

### **Week 11:**

Light-matter interactions, semiclassical treatment II: Electromagnetically induced transparency

### **Week 12:**

Cavity quantum electrodynamics

### **Week 13:**

Jaynes Cummings model