OSE 6349: Applied Quantum Mechanics for O&E – Syllabus Fall 2017

Class times and room	M/W 1:30pm - 2.45 pm, CREOL room 102
Instructor	Dr. Pieter G. Kik, Office 270, CREOL Phone 407-823-4622, e-mail kik@creol.ucf.edu
Class website	https://webcourses.ucf.edu
Office hours	T/R 11am-noon
Catalog description	*Presents the elements of quantum mechanics that are essential for understanding many areas in modern optics and photonics*
Credit Hours	3
Prerequisites	Graduate standing or consent of instructor

Detailed description

The aim of this course is to present the elements of quantum mechanics that are essential for understanding many areas in modern optics and photonics. This course will be useful background for pursuing more advanced courses in optoelectronics, solid state physics, semiconductor optics, and nonlinear optics, and essential background for studying quantum optics.

List of Topics

Atomic spectra; Wave-particle duality; Photo-electric effect; Linear vector spaces; Hermitian operators; Unitary transformations; Eigenvalue problems; Schrödinger's equation; The harmonic oscillator; Transfer matrix analysis: potential barriers and tunneling; Quantum wells; quantum wires; Boundary conditions for scattering, bound, and periodic states; Degenerate states; impurity states; density of states; Energy band gaps in periodic multilayer systems; Particle on a ring; Hydrogen atom; Angular momentum; Electron spin; the periodic table; Approximation methods: Time-independent perturbation theory, Variational theory, Time-dependent perturbation theory; Transition rates and the Einstein coefficients; Relaxation and dissipation in quantum mechanics; Lifetime and decoherence; Fluoresence and luminescence; Nonlinear optics.

Learning outcomes

Upon completion of the course, students will be able to analyze optical processes and optoelectronic devices in a quantum mechanical framework. The students will be familiar with the main quantum mechanical concepts that will allow them to pursue more advanced courses in quantum optics, semiconductor and solid-state physics, and modern optoelectronic and nanophotonic devices.

Recommended reference Texts

- *Quantum Mechanics for Scientists and Engineers*	D. A. B. Miller

Optional reference Texts

- *Molecular Quantum Mechanics*	P. Atkins
- *Applied Quantum Mechanics for Engineering, Materials Science, and Applied Physics*	H. Kroemer
- *Quantum Mechanics in One Dimension* (2004)	R. Gilmore

Homework	Weekly, handed out on Wednesday, due in class the following Wednesday
Assessment	Homework and quizzes (30%), mid-term exam (30%), final exam (40%). Plus and minus grades will be used
Final Exam	Monday, Dec 4, 2017, 1pm – 3.50pm (CREOL rooms 102/103)
Makeup exam policy	Makeup exams *only with prior permission from instructor*