**COURSE SYLLABUS**

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| **Course Title**：Electro-optical Thin Film Material Processes and Applications |
| **Credits / Hours** | 3/3 | **Course Number** |  | **□Required ■Elective** |
| **Course Description**The goal of this course is to give graduate students a thorough understanding of the thin film process technology and its applications. In this course, the fundamental relationships among properties, manufacturing processes and performances of materials will be introduced. Basic principles of processes used in microelectronic and photonic device fabrication: vacuum systems, plasma processes, physical and chemical deposition, properties of silicon and other substrate materials, photolithography and non-optical lithography, wet chemical and plasma etching, thermal oxidation of silicon, semiconductor doping, ion implantation, metallization, electrical contacts and micro-metrology are also discussed.Textbook: 1. Thin Film Physics Devices, J. Zu. 2021, 97898112239832.Handout edited by Professors |
| **Course Topics** |
| **Topic** | **Content** |
| Introduction | Introduction to electro-optical thin film material |
| Engineering Materials and Their Properties | Relationships among properties, manufacturing process and performances of materials |
| Introduction to Research in Electro-optics | Introduction to research methods, laboratory safety, ethics, proposal writing, technical presentations. |
| **Photonic Devices & Systems** | Solid state theory of optoelectronic devices; semiconductor photoemitters: LEDs, optical amplifiers and semiconductor lasers; photodetectors: PIN, APD, photocells, PMT, detection and noise; solar cells; cameras and displays; electro-optic and magneto-optic devices; integration and application of electro-optical components in systems of various types. |
| **Optical Thin Film Design** | Fundamental principles of optical thin film design and interference filters including: single-layer and multi-layer anti-reflection designs; high-reflection multi-layer designs; broad band reflectors; high-pass & low-pass filters; line filters; bandpass filters; metal film designs; design methods for oblique incidence; thin film beam splitters; numerical methods and optimization; thin-film manufacturing methods.  |
| **Principles of Nanofabrication** | Basic principles of processes used in microelectronic and photonic device fabrication: vacuum systems, plasma processes, physical and chemical vapor deposition, properties of silicon and other substrate materials, photolithography and non-optical lithography, wet chemical and plasma etching, thermal oxidation of silicon, semiconductor doping, ion implantation, metallization, electrical contacts and micro-metrology. |
| **Electro-Optic System Laboratory.** | iber optic principles and systems: numerical aperture, loss, dispersion, single and multimode fibers, communications and sensing systems. Project oriented investigations of electro-fiber-optic systems and devices in general: sources, detectors, image processing, sensor instrumentation and integration, electro-optic component, display technology, nonlinear optical devices and systems.  |