Microwave Physics and Techniques
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This course is a senior and/or a first year graduate level course and is designed for the students majoring in physics and electrical engineering. This course will provide the essential background and training materials in microwave physic and will include a review of the basic microwave theory and properties, transmission lines, Smith chart, impedance matching, field analysis of transmission lines, waveguides, and other resonance structures. Other topics include dielectric, radiation fields and scattering of electromagnetic waves, boundary conditions, microwave devices, cavities, and millimeter waves. Applications of various microwave techniques in the design and operation of synchrotron facilities will be discussed.

Instructor Syllabus: Topics will include: Maxwell's equations, Green's functions, boundary conditions, wave propagation and plane waves, plane wave reflection from a media interface, dielectric interface. Transmission line theory; including wave propagation, field analysis, generator and load mismatches, Smith chart, rectangular and circular waveguides, coaxial lines, microwave network analysis, impedance matching, microwave resonators, physics of the microwave tubes, dielectric and other lossy materials, time harmonic analysis, perturbation and variational techniques, microwave antennas, and microwave measurements; attenuation, SWR, impedance, phase-shift, noise factor. Millimeter waves and applications. Acceleration by rf systems for the linear accelerator and storage rings including beam and cavity interaction, beam-loading, higher - order mode (HOM) effects and mode damping. *Prerequisites*: *College Physics, introductory course in electromagnetism and first-year calculus. Familiarity with computers is useful, but not mandatory. The instructor will provide class notes and other background course materials. Recommended textbook: R.E. Collin, Foundation of Microwave Engineering, New York, New York: McGraw-Hill Publishing Company, 1994*.