Electrical Engineering: RF & Microwave Engineering

**EERF 6311** RF and Microwave Circuits (3 semester credit hours) Analysis and design of RF and microwave circuits. Topics include impedance matching, network theory, S-parameters, transmission line media (waveguide, coax, microstrip, stripline, coplanar waveguide, etc.) and passive component design (power dividers, couplers, switches, attenuators, phase shifters, etc.). Industry-standard microwave CAD tools will be used. Prerequisite: **EE 4368** or equivalent. (3-0) R

**EERF 6330** RF Integrated Circuit Design (3 semester credit hours) Introduction to RF and wireless systems; basic concepts of RF design: linearity, distortion, (P1dB, IIP3), sensitivity, noise figure; RF passives: Q-factors, impedance transformation, matching network; transceiver architectures: Receivers - Heterodyne, direct down-conversion, image reject receivers, direct conversion transmitter, two-step transmitter; low noise amplifier design; mixer design; oscillator design; basic architectures of power amplifiers. Industry-standard CAD tools will be used for design projects. Prerequisite: **EE 4340.** (3-0) Y

**EERF 6340** Active Microwave Design Laboratory (3 semester credit hours) Design of linear and non-linear microwave active circuits. Theory and design procedures are comprehensively studied including: component characterization, biasing, linear and non-linear analysis. Students will design, fabricate, and characterize several circuit types to demonstrate mastery of design procedures. Course projects may include, but are not limited to: low-noise amplifiers, mixers, VCOs, and power amplifiers. Commercially available CAD tools will be used for design. Corequisite: **EERF 6355** or **EERF 6330.** Prerequisites: **EERF 6311** and **EERF 6396.** (2-1) R

**EERF 6351** Computational Electromagnetics (3 semester credit hours) Review of Maxwell's equations; numerical propagation of scalar waves; finite-difference time-domain solutions of Maxwell's equations; numerical implementations of boundary conditions; numerical stability; numerical dispersion; absorbing boundary conditions for free space and waveguides; selected applications in telecommunications, antennas, microelectronics and digital systems. Prerequisite: **EE 4301** or equivalent. (3-0) R

**EERF 6355** RF and Microwave Amplifier Design (3 semester credit hours) Design of narrow band, and broadband amplifiers. Study of stability on amplifiers. Study of noise figure, noise parameters and noise sources. Low noise amplifier design. Study of distortion on amplifiers. Introduction to power amplifiers. Microwave amplifier design in integrated circuits. Prerequisite: **EERF 6311** or equivalent. (3-0) R

**EERF 6393** Microwave Power Amplifiers (3 semester credit hours) RF/Microwave transistor power amplifier (PA) applications and fundamental linear and non-linear performance objectives are studied such as: output power, efficiency, and distortion. Key amplifier classes and design topologies are studied. Students will complete CAD design projects to demonstrate mastery of relevant techniques. Prerequisite: **EERF 6311** or equivalent. Corequisite: **EERF 6355** or equivalent. (3-0) R

**EERF 6394** Antenna Engineering and Wave Propagation (3 semester credit hours) Operating principles for microwave antennas used in modern wireless communications and radar systems. Instructor consent required. (3-0) T

**EERF 6395** RF and Microwave Systems Engineering (3 semester credit hours) Review of RF and microwave
systems, such as cellular, point-to-point radio, satellite, RFID and RADAR. Topics include: system architectures, noise and distortion, antennas and propagation, transmission lines and network analysis, active and passive components, modulation techniques and specification flowdown. Prerequisite: EE 4368 or equivalent. (3-0) R

**EERF 6396** Microwave Design and Measurement (3 semester credit hours) This lecture and lab course covers the fundamentals of microwave component design and measurements, including vector impedance (scattering parameters), scalar measurements and spectrum analysis. Microwave components, such as filters, directional couplers, switches, amplifiers, and oscillators, will be designed and simulated with various CAD tools and then built and measured to compare performance with theory. Lab fee of $30 required. Prerequisite: EE 4368 or equivalent. (2-1) R

**EERF 7V89** Special Topics in RF and Microwave Systems (1-6 semester credit hours) May be repeated for credit as topics vary (9 semester credit hours maximum). ([1-6]-[0-3]) R