EWCA, Inc. Course EW-1000

Topical Outline

Each lecture consists of two 55-minute instructional periods and a 10-minute break

Lecture Group One – Electromagnetic Wave Fundamentals – 3 lectures

Topics include: Vectors, Radiation Condition, Frequency, Period, Wavelength, Phase, Phase Shift, Phase Front, Plane Waves, Electric Field Component, Polarization, Magnetic Field Component, Free Space Impedance, Poynting Vector, Power Spatial Density, Superposition, Antenna Basics, Antenna Patterns

Lecture Group Two – Radar Signals Characterization – 2 lectures

Topics include: Time-Frequency Duality, Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform (FFT), Continuous Wave (CW) Signals, Coherent Signals, Non-Coherent Signals, Radio Frequency, Mixer, Intermediate Frequency, Detector, Video, Pulsed Signal, Repetitively Pulsed Signal, Pulsed Doppler Signal, Power Spectral Density, Low Pass Filter, Band Pass Filter, Spectrum Analyzer

Lecture Group Three – Search Radar Basics – 5 lectures

Topics include: Basic Radar Principles, Types of Search Radars, The Radar Power Equation, Radar Cross Section (RCS) Definition and Characteristics, Scatter Mechanisms, RCS Reduction, System Block Diagram, Transmitter, TR/ATR Switch, Circulator, Waveguides, Coaxial Cables, Connectors, Couplers, Transmission Modes, Characteristic Impedance, Matched Loads, Reflection Coefficients, Voltage Standing Wave Ratio (VSWR), Antennas as Impedance Transformers, Transmit Antenna, Receive Antenna, Local Oscillator, Mixer, IF Amplifier, Detector, Displays, Detecting Signals in Noise, Probability Density Functions, Setting Detection Thresholds, Constant False Alarm Rate (CFAR), Probability of False Alarm, Probability of Detection, Extracting Target Information – Range and Doppler, Resolution

Lecture Group Four - Radar Transmitters - 2 lectures

Topics include: Transmitter Introduction, Klystrons, Traveling Wave Tubes, Cross-Field Amplifiers, Magnetrons, Solid-State Transmitters, Modulators

Lecture Group Five – Radar Antennas – 3 lectures

Topics include: Parabolic Reflectors, Feed Horns, Cassegrain Configuration, Twist/Trans Reflectors, Scanning Beams – Fan Beams, Lewis Scanner, Organ Pipe Scanner, Lens Fed Arrays, Frequency Scanned Arrays, Conical Scan,

Monopulse Antenna Feed, Corporate Phased Arrays, Transmissive and Reflexive Phased Arrays, and Active Element Arrays

Lecture Group Six – Radar Tracking Loops Overview – 3 lectures

Topics include: z-Transform, Feedback, Control Loops, Bandwidth, Stability, Type I, Type II; Introduction to Optimal Filtering; Applications to Range, Doppler and Angle Tracking

Lecture Group Seven – Reinforcement and Review – 2 lectures

Topics include: Revisit specific topics identified by students and instructors for which further exploration is desired.