EX 725 01

**Course Objectives:**

1. To enable the student to become familiar with Radar technology
2. To get an overview of Radar and the Radar equation
3. To study about different types of radars and their operations
4. To study about Radar transmitters, receivers, duplexers, displays and antennas
5. To get a knowledge about the detection of Radar signals in noise
6. **Introduction to Radar (2 hours)**
   1. Introduction
   2. Radar block diagram and operation
   3. Applications of Radar
   4. Radar frequencies

1. **The Radar equation (8 hours)**
   1. Simple form of Radar Equation
   2. Prediction of range performance
   3. Minimum detectable signal
   4. Receiver noise
   5. Signal to Noise ratio
   6. Integration of Radar Pulses
   7. Radar Cross Section of Targets (simple targets - sphere, cone-sphere)
   8. Transmitter Power
   9. Pulse repetition frequency and range ambiguities
   10. System losses
   11. Propagation effects

1. **CW and Frequency Modulated Radar (4 hours)**
   1. The Doppler effect
   2. CW Radar
   3. FM-CW Radar
   4. Multiple Frequency CW Radar

1. **MTI andPulse Doppler Radar (8 hours)**
   1. Moving Target indicator Radar
   2. Delay Line and Cancellers
   3. Staggered Pulse Repetition Frequencies
   4. Range Gated Doppler Filters,
   5. Other MTI delay line,
   6. Limitations of MTI performance,
   7. Non-Coherent MTI
   8. Pulse Doppler Radar
   9. MTI from a moving platform
   10. Limitations of MTI performance
   11. MTI versus Pulse Doppler Radar

1. **Tracking Radar (6 hours)**
   1. Tracking with Radar
   2. Sequential Lobbing
   3. Conical Scan
   4. Monopulse Tracking Radar
   5. Tracking in range
   6. Acquisition
   7. Comparison of Trackers

1. **Radar Transmitters, Receivers, Duplexers, Displays and  Antennas(10 hours)**
   1. Radar Transmitters
      1. Introduction
      2. Solid state transmitters
      3. Introduction to Radar Modulators
   2. Radar Receivers
      1. Introduction
      2. Super Heterodyne Receiver
      3. Receiver Noise Figure
   3. Duplexers
      1. Introduction
      2. Branch type and Balanced type
   4. Displays
      1. Introduction and types
   5. Antennas
      1. Introduction
      2. Parameters of Radar Antenna
      3. Phased Array Antenna
      4. Basic Concepts
      5. Radiation Pattern
      6. Applications, Advantages and Limitations

1. **Detection of Radar Signals in Noise(5 hours)**
   1. Introduction,
   2. Matched Filter Receiver
      1. Response Characteristics and Derivation
   3. Correlation Detection
      1. Correlation Function and Cross-correlation Receiver

1. **Image Analysis and Applications (2 hours)**

**Practical:**

1. Field trip to Airport for the introduction of Air Traffic Control (ATC) Radar.
2. Radar Cross Section Simulation and Analysis
3. Case Study

**References:**

1. Merrill I. Skolnik, “Introduction to Radar Systems”, MacGraw Hill
2. MerrillI.Skolnik, “Radar Handbook”, McGraw Hill Publishers
3. J. C. Toomay and Paul J. Hannen, “Radar Principles for the Non-Specialist”, by J. C. Toomay, Paul Hannen, SciTech Publishing
4. David Knox Barton, A. I. Leonov, Sergey A. Leonov, I. A. Morozov and Paul C. Hamilton, “Radar Technology Encyclopedia”, Artech House.
5. Dr. Eli Brookner (Editor), “Radar Technology”, Artech House.
6. M. R. Richards, J. A. Scheer, W. A. Holm, Editors “Principles of Modern Radar, Basic Principles”, SciTech Publishing.

**Evaluation Scheme:**  
The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

|  |  |  |
| --- | --- | --- |
| **Chapters** | **Hours** | **Marks Distribution\*** |
| 1 | 2 | 4 |
| 2 | 8 | 14 |
| 3 | 4 | 6 |
| 4 | 8 | 14 |
| 5 | 6 | 12 |
| 6 | 12 | 22 |
| 7 | 5 | 8 |
| **Total** | **45** | **80** |

\*There could be a minor deviation in Marks distribution