

# GUJARAT TECHNOLOGICAL UNIVERSITY

## B.E. SEMESTER : VIII

### ELECTRONICS AND COMMUNICATION ENGINEERING

Subject Name: **RADAR AND NAVIGATIONAL AIDS**

| Sr. No. | Course Contents   |
|---------|---|
| 1.      | <b>Principles of Radar:</b> Introduction, The simple form of Radar Equation, Radar Block diagram and Operation, Radar Frequencies, millimeter and submillimeter waves, Applications of Radar.   |
| 2.      | <b>Radar Equation:</b> Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Signal to Noise Ratio, Matched filter impulse response, Integration of radar Pulses, Radar Cross Section of Targets, Cross section Fluctuations, Radar Clutter-surface clutter, sea clutter and Land clutter ,weather clutter, Transmitter Power, Pulse Repetition Frequency and Range ambiguities, Antenna Parameters, system losses, propagation effects, other considerations |
| 3.      | <b>Antennas for Radar &amp; Navigation :</b> Introduction, Fundamental Antenna Concept, Reflector Antennas ,phased Array antennas, Loop Antenna   |
| 4.      | <b>CW and FM Radar:</b> The Doppler effect, CW radar, FMCW radar, Airborne Doppler Navigation, Multiple Frequency CW radar  |
| 5.      | <b>MTI and Pulse Doppler Radar:</b> Introduction, Delay line Cancellers, Multiple or staggered Pulse Repetition Frequencies, Range gated Doppler Filters, Block Diagram of Digital Signal Processor, Example of MTI radar Processor, , Pulse Doppler Radar, Non coherent MTI ,MTI from moving platform, Other types of MTI, Airborne radar.   |
| 6.      | <b>Tracking and Imaging Radar:</b> Tracking with radar, Monopulse tracking, Conical scan and sequential lobing, Low angle tracking, Air Surveillance Radar, Introduction to Synthetic aperture radar(SAR).  |
| 7.      | <b>Navigation:</b> Introduction, Four Methods of Navigation.  |
| 8.      | <b>Radio Direction Findings:</b> Loop Antenna, Loop input circuits, aural null direction finder, Goniometer, Errors in Direction Finding, Adcock Direction Finder, Its advantages over loop antenna, Direction Finding at very high frequency, Automatic Direction Finder, Range and Accuracy of Direction Finders.   |
| 9.      | <b>Radio Ranges:</b> LF/MF Four course Radio Range, VHF Omni Directional Range, and VOR receiving Equipment, Range and Accuracy of VOR.   |
| 10.     | <b>Hyperbolic Systems of Navigation:</b> LORAN, DECCA navigation system   |
| 11.     | <b>Aids to approach and Landing:</b><br>Instrument Landing System, Ground controlled Approach System, Microwave landing system , Distance Measuring Equipment, TACAN,   |
| 12.     | <b>Modern Navigation :</b> Doppler navigation-Doppler Effect, New configuration, Doppler frequency equations, Track stabilization, Doppler navigation system , GPS principle of operation, Position location determination, principle of GPS receiver.  |

#### Text Books:

1. Skolnik, M., " Introduction to Radar Systems", Tata McGraw-Hill, 3rd Edition, 2001
2. N.S.Nagaraja, "Elements of Electronic Navigation Systems", Tata McGraw-Hill, 2nd Edition, 2000

#### Reference Book:

1. Peyton Z. Peebles:, "Radar Principles", JohnWiley, 2004
2. J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004