

RADAR AND NAVIGATION

Paper Code: ETEC-419
Paper: Radar and Navigation

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INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objectives: To study the basic of radar systems and their use in different navigation systems.

UNIT I

Introduction to Radar: Basic Radar – The Origins of Radar, radar system (block diagrams), Radar range Equation, Applications of Radar. Radar types: MTI, Doppler and Pulse, PRF, Delay, Line Cancellers, Staggered Pulse Repetition Frequencies, Doppler Filter Banks, Digital MTI Processing, Moving Target Detector, Limitations to MTI Performance, Pulse Doppler Radar. Tracking with Radar-Monopulse Tracking, Conical Scan and Sequential Lobing, Limitations to Tracking Accuracy, Low-Angle Tracking - Tracking in Range, Comparison of Trackers, Automatic Tracking with Surveillance Radars.

[T1][R1][No. of Hrs. 11]

UNIT II:

Radar Receiver: Introduction, Superheterodyne Receiver, Receiver noise Figure, Duplexers and Receiver Protectors, Radar Displays. Matched Filter Receiver, Detection Criteria, Detectors, Automatic Detector, Integrators, Constant-False-Alarm Rate Receivers, The Radar operator, Signal Management, Propagation Radar Waves, Atmospheric Refraction, Standard propagation, Nonstandard Propagation, The Radar Antenna, Reflector Antennas, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency-Scan Arrays

[T1][R1][R2][No. of Hrs. 11]

UNIT III

Radar Transmitters- Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources – Other aspects of Radar Transmitter.

Detection of Signals in Noise –Detection of Signals in Noise, Receiver Noise and the Signal-to-Noise Ratio, Probability Density Functions, Probabilities of Detection and False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets, Radar cross Section fluctuations, Transmitter Power.

[T2][R3][No. of Hrs. 11]

UNIT IV

Navigation – Introduction, Four methods of Navigation, Radio Direction Finding, The Loop Antenna, Loop Input Circuits, An Aural Null Direction Finder, The Goniometer, Errors in Direction Finding, Adcock Direction Finders, Direction Finding at Very High Frequencies, Automatic Direction Finders, The Commutated Aerial Direction Finder, Range and Accuracy of Direction Finders, Radio Ranges, Doppler Navigation, component, Beam Configurations, Track Stabilization, introduction to Satellite Navigation System, Global Positioning System(GPS).

[T1][R1][No. of Hrs. 11]

Textbooks:

- [T1] Merrill I. Skolnik, "Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2003.
 [T2] N.S.Nagaraja, "Elements of Electronic Navigation Systems", 2nd Edition, TMH, 2000.

Reference books:

- [R1] Gottapu Sasi Bhushana Rao, "Microwave and RADAR Engineering". Pearson publication.
 [R2] Peyton Z. Peebles, "Radar Principles", Johnwiley, 2004
 [R3] J.C Toomay, "Principles of Radar", 2nd Edition –PHI, 2004