COURSE TITLE : RADAR AND NAVIGATION
COURSE CODE : 6045
COURSE CATEGORY : E
PERIODS/WEEK : 4
PERIODS/SEMESTER : 60/6
CREDITS : 4

TIME SCHEDULE

Module	Topics	Periods
1	Introduction to Radar	15
2	Types of Radar	15
3	Navigation	15
4	Approach and Landing Aids	15
	Total	**60**

Course general outcome :

Module	GO	On completion of the study of this course the students will be able :
1	1	To understand the concept of Radar , its applications and different Radar performance factors
2	2	To understand the operation of FM - CW Radar
	3	To understand the operation of MTI & Pulse Doppler Radar
3	4	To understand the concept of Navigation and types of radio navigation
4	5	To understand the two types of landing systems
	6	To understand satellite navigation systems

GO - General Outcome

On the completion of the study the student will be able :

MODULE - I - INTRODUCTION TO RADAR

1.1.0 To understand the concept of Radar, its applications and different Radar performance factors

1.1.1 To describe the block diagram of Radar
1.1.2 To state the Radar frequency ranges
1.1.3 To list the applications of Radar

1.1.4 To derive Radar range equation

1.1.5 To explain the Radar performance factors

MODULE - II - TYPES OF RADAR

2.1.0 To understand the operation of FM -CW Radar

2.1.1 To explain Doppler effect with equation (no derivation)

2.1.2 To explain the block diagram of FM - CW Radar

2.1.3 To explain the block diagram of FM - CW super heterodyne receiver

2.2.0 To understand the operation of MTI & Pulse Doppler Radar

2.2.1 To explain the operation of MTI Radar

2.2.2 To explain the operation and block diagram of MTI Radar employing power amplifier

2.2.3 To explain the operation of delay line cancellers

2.2.4 To explain the block diagram of MTI Signal Processor

2.2.5 To describe the operation of Pulse Doppler Radar

2.2.6 To explain Tracking Radar and list out its types

2.2.7 To explain the types of Radar displays

MODULE - III - RADIO NAVIGATION

3.1.0 To understand the concept of Navigation and types of radio navigation

3.1.1 To define the concept of navigation

3.1.2 To describe the four methods of navigation

3.1.3 To explain the working of loop antenna and Goniometer

3.1.4 To explain the working principle of ADF / NDB – Radio compass ADF, VHF phase comparison ADF

3.1.5 To explain the working principle of hyperbolic navigation systems – LORAN, Omega, DECCA

3.1.6 To explain the principle of different types of radio ranges - VOR, Doppler VOR, DME

MODULE - IV - APPROACH AND LANDING AIDS

4.1.0 To understand the two types of landing systems

4.1.1 To explain the function of components in an Instrument Landing System (ILS) with the help of diagram

4.1.2 To explain the significance of glide slope and markers

4.1.3 To explain Microwave Landing System (MLS)

4.1.4 To Understand satellite navigation systems

4.1.5 To state the basic principle of INS and DNS

4.1.6 To explain the basic ideas of GPS and DGPS

4.1.7 To explain GNSS and its classification

CONTENT DETAILS

Module - I Introduction to Radar

Radar – concept - block diagram – operation – frequency ranges – applications – range equation – derivation (no problems) - Radar performance factors – minimum detectable signal -receiver noise – Signal to Noise ratio -Radar cross section of targets – transmitter power – pulse repetition frequency – range ambiguities

Module - II - Types of Radar

Doppler effect - FM - CW Radar - FM - CW Radar with super heterodyne receiver – block diagram - MTI Radar - MTI Radar with power amplifier transmitter -delay line cancelers - MTI Signal Processor - Pulse Doppler Radar - Tracking Radar – basic block diagram – types - Radar displays – A Scope – PPI Scope

Module - III - Radio Navigation

Navigation - methods of navigation - Radio direction finder - loop antenna – goniometer - Radio Navigation systems - ADF / NDB – Radio compass ADF, VHF phase comparison using ADF - Hyperbolic navigation systems – basic principle - LORAN, Omega, DECCA - Radio ranges – VOR – ground equipment – VOR receiver - Doppler VOR – DME

Module - IV - Approach and landing aids

Instrument Landing System (ILS) – elements – localizer - glide slope – marker beacons -lighting systems – operation – limitation - Microwave Landing System (MLS) – operation – advantages – disadvantages - Navigation systems – INS – DNS -
Satellite Navigation systems – GPS – DGPS – GNSS – COMPASS – DORIS – GALILEO – IRNSS – QZSS (concept only)

Text Book

1. Introduction to Radar Systems – Merrill I. Skolnik – McGraw Hill

Reference

1. Radar Systems and Radio Aids to Navigation – Dr. A. K. Sen, Dr. A. B. Bhattacharya Khanna Publishers
2. Elements of Electronic Navigation – N. S. Nagaraja – Tata McGraw Hill
3. Radar, Sonar and Navigation Engineering – K. K. Sharma – Katson Books