



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

ASSIGNMENT QUESTIONS

Course Name	:	RADAR SYSTEMS
Course Code	:	A80450-R15
Class	:	IV - B. Tech II sem
Branch	:	Electronics and Communications Engineering
Year	:	2018 – 2019
Course coordinator	:	Mrs. V.Bindusree, Assistant Professor, ECE.
Course Faculty	:	Mrs. J.Swetha, Assistant Professor, ECE. Mrs. V.Bindusree, Assistant Professor, ECE.

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

ASSIGNMENT-I			
UNIT -I			
BASICS OF RADAR AND RADAR EQUATION			
S. No	Questions	Blooms Taxonomy level	Course Outcome
1	Discuss the parameters on which maximum detectable range of a radar system depends.	Understand	1
2	Illustrate the specific bands assigned by the ITU for the radar? What the corresponding frequencies?	Understand	1
3	What are the different range frequencies that radar can operate and give their applications?	Understand	1
4	What are the basic functions of radar? In indicating the position of a target, what is the difference between azimuth and elevation?	Understand	1
5	Derive fundamental radar range equation governed by minimum receivable echo power S_{min} .	Remember	1
6	Draw the functional block diagram of simple pulse radar and explain the purpose and functioning of each block in it.	Remember	1
7	List major applications of radar in civil and military systems.	Remember	1
8	With the help of a suitable block diagram explain the operation of a pulse radar.	Understand	1
9	Explain how the Radar is used to measure the range of a target?	Understand	1

10	Write the simplified version of radar range equation and explain how this equation does not adequately describe the performance of practical radar?	Understand	1
11	Describe how threshold level for detection is decided in the presence of receiver noise for a specified probability of occurrence of false alarms.	Understand	2
12	Describe the effect of pulse repetition frequency on the estimated unambiguous range of radar.	Remember	2
13	Obtain the SNR at the output of IF amplifier of radar receiver for a specified probability of detection without exceeding a specified probability of false alarm.	Understand	2
14	Explain system losses will effect on the radar range?	Understand	2
15	Discuss about the factors that influence the prediction of radar range.	Understand	2
16	Describe the effect of (in terms of wavelength of operation) size of a simple spherical target on determination of radar cross section of the sphere.	Understand	2
17	What are multiple-time-around echoes? Explain the relation between Un-ambiguous range estimation and multiple-time-around echoes.	Understand	2
18	Justify the requirement of integration of radar pulses to improve target detection process.	Understand	2
19	Estimate the radar cross-section of a spherical target if the wavelength of transmitting signal with reference to the target size is in Rayleigh region.	Remember	2
20	List all the possible losses in a radar system and discuss the possible causes of each of them.	Understand	2

UNIT – II

CW AND FREQUENCY MODULATED RADAR

S. No	Questions	Blooms Taxonomy level	Course Outcome
1	With the help of a suitable block diagram, explain the operation of CW Doppler radar in a sideband super heterodyne receiver.	Understand	3
2	List the limitations of CW radar and explain.	Remember	3
3	What is Doppler frequency shift? Establish a relation between Doppler frequency shift and radial velocity of a moving target.	Remember	3
4	Explain how isolation between transmitter and receiver of a radar system can be achieved if single antenna is used for transmission and reception.	Understand	3
5	What is Doppler frequency shift? Discuss the effect of receiver bandwidth on the efficiency of detection and performance of a CW Doppler radar.	Understand	3
6	With the help of a suitable block diagram, explain the operation of a CW tracking illuminator application of a CW radar.	Understand	3
7	With the help of a suitable block diagram, explain the operation of a CW radar with non- zero IF in the receiver.	Understand	3
8	Write the applications of CW Radar.	Remember	3
9	What are the factors that limit the amount of isolation between Transmitter and Receiver of CW Radar?	Remember	3
10	With the help of suitable block diagram, explain the operation of a FM-CW altimeter.	Understand	4

11	List out the possible errors for measurement of altitudes accurately using a FM-CW altimeter and explain.	Remember	4
12	Discuss the results of multiple frequency usage for operating FM-CW radar while mentioning the limitations of multiple frequency usage in CW radars.	Understand	4
13	Describe Range and Doppler measurement of a target using a FM-CW radar.	Understand	4
14	Why the step error and quantization errors which occur in cycle counter are used for frequency measurement in FMCW Radar?	Understand	4
15	How to select the difference between two transmitted signals of CW radar?	Understand	4
16	What are the various unwanted signals which cause errors in FM altimeter?	Understand	4
17	Explain Mono pulse tracking in two angle coordinates.	Understand	4

UNIT-III MTI AND PULSE DOPPLER RADAR

S. No	Questions	Blooms Taxonomy level	Course Outcome
1	What is a delay line canceller? Illustrate the concept of blind speeds based on the frequency response of a single delay line canceller.	Understand	5
2	Discuss the factors limiting the performance of an MTI system.	Remember	5
3	What are blind speeds? Suggest a method to reduce the effect of blind speeds for unambiguous detection of a moving target.	Understand	5
4	Explore the possibility of broadening the clutter rejection null using a second delay line canceller in the MTI radar system.	Understand	5
5	Describe automatic tracking of a target through range gating technique for unambiguous detection of a moving target.	Understand	5

ASSIGNMENT-II

6	Explore the possibility of broadening the clutter rejection null using second delay line canceller in the MTI radar system.	Understand	5
7	With the help of necessary block diagram explain the operation of an MTI radar system with a power amplifier in the transmitter.	Understand	5
8	Compare and contrast the situations with a power amplifier and a oscillator in the transmitter of an MTI system.	Remember	5
9	Describe the method of staggering pulse repetition frequency to reduce the effect of blind speeds in an MTI system.	Understand	5
10	Explain the following limitations of MTI radar. (a) Equipment instabilities. (b) Scanning modulation. (c) Internal fluctuation of clutter.	Understand	5

UNIT-IV TRACKING RADAR

S. No	Questions	Blooms Taxonomy level	Course Outcome
1	Discuss the effect of surface quality and reaction characteristics of a target on the angular tracking accuracy of tracking radar.	Understand	6
2	Describe the phase comparison mono pulse tracking technique in a radar system with the help of necessary block diagram.	Understand	6

3	With the help of a suitable block diagram, discuss the Sequential lobbing type of tracking technique in a tracking radar system.	Understand	6
4	Compare and contrast conical scan and sequential lobbing type tracking techniques.	Remember	6
5	Describe the process of acquiring a moving target prior to tracking it along with the patterns used for acquisition.	Understand	6
6	Describe automatic tracking of a target through range gating technique.	Understand	6
7	Describe sequential lobbing type of error signal generation to track a target automatically.	Understand	6
8	List the merits and demerits of mono pulse tracker over conical scan type tracker.	Remember	6
9	Draw the block diagram of an amplitude comparison mono pulse tracking radar in azimuth and elevation directions. Explain the Functioning of this two dimensional tracking radar.	Remember	6
10	Why does have poor accuracy at low elevation angles? Explain tracking radar.	Understand	6

UNIT-V
DETECTION OF RADAR SIGNALS IN NOISE

S. No	Questions	Blooms Taxonomy level	Course Outcome
1	Explain the principle behind the operation of duplexers and receiver Protectors.	Understand	7
2	Explain how a circulator can be utilized for a radar receiver protection.	Understand	7
3	Define noise figure and noise temperature of a receiver system.	Remember	7
4	Describe the principle behind the operation of a phased array antenna in a radar system.	Understand	7
5	Derive the impulse response of a matched filter that is commonly used in a radar system.	Remember	7
6	Substantiate the requirement of duplexers in efficient radar systems. Describe the operation of branch and balanced type duplexers with necessary diagrams.	Understand	7
7	Describe any of two types of duplexers used in radar receivers.	Understand	7
8	Define noise figure and equivalent noise temperature of a radar receiver.	Remember	7
9	Discuss in detail about Matched-filter Receiver with necessary expressions.	Understand	7
10	Explain the function of time domain filter with an example.	Understand	7
11	List out the general characteristics and bring out requirements for a radar receiver	Understand	8
12	Define noise figure and noise temperature of a receiver system.	Understand	8
13	Derive the expression for the noise figure of two networks that are in cascade.	Remember	8
14	Explain about any two mixers	Understand	8
15	What is low noise front end? What are its applications?	Understand	8
16	Describe briefly various visual displays to view radar echo signals in radar systems	Understand	8

17	Explain the following: (a) Balanced type duplexer (b) Branch type duplexer.	Remember	8
18	Explain how a circulator can be utilized for a radar receiver protection.	Understand	8
19	Describe the principle behind the operation of a phased array antenna in a radar system. Explain its radiation pattern	Understand	8
20	Briefly explain the concept of beam steering phased array antennas.	Understand	8

Prepared by:

Mrs. J.Swetha, Assistant Professor, ECE.
Mrs. V.Bindusree, Assistant Professor, ECE.

HOD, ECE