R07

IV B.Tech I Semester Examinations, May 2011 RADAR SYSTEMS Electronics And Telematics

Time: 3 hours

Code No: 07A7EC15

Max Marks: 80

Answer any FIVE Questions All Questions carry equal marks *****

- 1. (a) Differentiate blind phases from blind speeds.
 - (b) Discuss the various types of MTI delay lines used in MTI radar. [8+8]
- 2. (a) Explain how the target detection decision is made in Radar receiver?
 - (b) How the radar cross section of a sphere varies as a function of circumference measured in wavelengths? [8+8]
- 3. (a) Describe the essential characteristics, functions and major applications of search Radar Systems.
 - (b) Describe Acquisition with respect to Tracking radar. [8+8]
- 4. (a) What are the various unwanted signals which cause errors in FM altimeter?
 - (b) Explain the two frequency CW technique for measuring the Radar range? [8+8]
- 5. (a) What effect does the local oscillator have on the receiver's dynamic range?
 - (b) Distinguish between electrostatic and electromagnetic deflection. [8+8]
- 6. Give an idea about prediction of range, detection of signal in noise and receiver noise and S/N ratio. [16]
- 7. (a) Write the simplifier version of radar range equation and explain how this equation does not adequately describe the performance of practical radar?
 - (b) What are the specific bands assigned by the ITU for the Radar? What the corresponding frequencies? [8+8]
- 8. (a) Explain how the sign of the Doppler frequency is found by splitting the received signal in CW radar?
 - (b) Drive the expression for doppler frequency and plot it as a function of radar frequency and target radial velocity. Assume necessary parameters.

[8+8]

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- 1. (a) Draw the block diagram of FMCW radar and explain each block.
 - (b) Explain how a multiple frequency CW radar can be used to measure unambiguous range? [8+8]
- 2. Explain in detail about Target-reflection characteristics and Angular Accuracy.

3. (a) Why Beat frequency amplifier is used in CW Radar? Explain its principle of working with frequency response characteristics.

- (b) Draw the block diagram of sideband super heterodyne CW Radar receiver and explain each block. [8+8]
- 4. (a) What is maximum unambiguous range? How to find it?
 - (b) Explain how a single antenna can be used for both transmitter and receiver of pulse radar?
 - (c) Consider for a given radar, if minimum receiver sensitivity is -120dB, transmitted peak power is 100kW, gain of antenna is 30dB, target cross section is 5 square meter and maximum range of the radar is 300km, calculate the effective area of the receiving antenna. [4+4+8]
- 5. (a) Calculate the maximum range of a radar system which operates at 3 cm with a peak pulse power of 500 kW, if its minimum receivable power is 10^{-13} W, the capture area of its antenna is 5 m^2 , and the radar cross-sectional area of the target is 20 m^2 .
 - (b) Define a integration efficiency of Radar pulses.
 - (c) What is the false alarm number? How to calculate it? [6+4+6]
- 6. (a) Draw the output waveforms from mixer for the different range of Doppler frequency.
 - (b) Write short notes on interclutter visibility, MTI inprovement factor and clutter attenuation. [8+8]
- 7. List the major difficulties occasioned by the use of moving radar antennas. How can phased arrays overcome these difficulties. [16]
- 8. Derive the impulse response of a matched filter that is commonly used in a radar receiver. [16]

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- 1. (a) Explain how the Radar is used to measure the range of a target?
 - (b) Draw the block diagram of the pulse radar and explain the function of each block. [8+8]
- 2. (a) Explain how the noise is limiting the Radar receiver sensitivity?
 - (b) What are the collapsing losses? Give the mathematical equation for it, and explain each parameter. [8+8]
- 3. (a) Describe the conical scanning method.
 - (b) Explain how AGC is achieved in conical scan tracking Radar receiver. [8+8]
- 4. (a) Explain the limitations of MTI Radar.
 - (b) Explain how the effects of blind speeds reduced by operating at more than one PRF? [8+8]
- 5. Describe the functions of the more important controls that may be provided with an A - scope radar display. [16]
- 6. (a) Draw the block diagram and explain the operation of a CW Doppler radar using an intermediate frequency in the receiver. How have the drawbacks of the basic CW radar been overcome?
 - (b) With a (CW) transmit frequency of 5 GHz, calculate the Doppler frequency seen by a stationary radar when the target radial velocity is 100km/h(62.5mph). [8+8]
- 7. Explain the principle and characteristics of a matched filter hence derive the expression for frequency response function. [16]
- 8. (a) Why the step error and quantization errors which occur in cycle counter are used for frequency measurement in FMCW Radar?
 - (b) Draw the block diagram of sinusoidally modulated FMCW radar and explain the function of each block. [8+8]

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- 1. (a) What is the Doppler effect? Explain how it is used in CW Radar?
 - (b) Explain why isolation between transmitter and receiver is required in the CW Radar? what are the devices used for isolation? [8+8]
- 2. (a) Explain the basic principle of low angle tracking.
 - (b) How is radar target acquired in a typical radar.
- 3. (a) Explain the transmission lines losses introduced in higher radar frequencies and also write the name of other components responsible for plumbing losses.
 - (b) Explain how the Radar cross-section depends on distance? [8+8]
- 4. (a) Discuss about non white noise matched filter.
 - (b) Discuss about the Fourier transform criterion. [8+8]
- 5. Describe the two different types of phased array radar and compare their relative merits and demerits. [16]
- 6. (a) Explain how to choose the PRF at which Radar pulses may be transmitted?
 - (b) Write the three forms of Radar range equation and to give the importance of each term in these equations. [8+8]
- 7. (a) Explain how a multiple frequency CW radar technique is used for the accurate measurement of distance in surveying and in missile guidance?
 - (b) What is FM altimeter? Explain how it works and what are the applications of it? [8+8]
- 8. (a) An MTI radar is operated at 9GHz with a PRF of 3000 pps. Calculate the first two lowest blind speeds for this radar. Derive the formula used.
 - (b) Discuss the liminations of non-cohorent MTI Radar systems. [12+4]
