

**IV B.Tech II Semester Regular Examinations, Apr/May 2008**

**RADAR ENGINEERING**

**(Electronics & Communication Engineering)**

**Time: 3 hours**

**Max Marks: 80**

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

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1. (a) Obtain the Radar equation and discuss the various parameters which improve the performance of the Radar.  
(b) Explain about applications of radar. [10+6]
2. Discuss in detail about the different types of losses that occur through out the radar system. [16]
3. (a) Explain the principle of operation FMCW Altimeter with suitable diagram.  
(b) An 8GHz police Radar measures a Doppler frequency of 1788Hz from a Car approaching the stationary police vehicle in an 80km/h speed limit zone. What should the police officer do? [10+6]
4. (a) What is the difference between single cancellation and double cancellation in delay line cancelers? Explain.  
(b) An MTI Radar system operating at 10GHz and a repetition rate of 1000Hz receives echoes from an aircraft that is approaching the radar with a radial velocity component of 1 km /sec. Determine the radial velocity component as measured by the radar. [8+8]
5. Distinguish the principle of operation of a simple pulse radar from a simple CW radar. Explain the difference with neat schematic block diagrams. [16]
6. (a) Compare the tracking techniques.  
(b) Explain in detail about limitations to tracking accuracy. [10+6]
7. (a) List out the different types of displays used for radar applications, and their characteristics.  
(b) Three network units, each of 6 dB noise figure and 10 dB, 6 dB and 3 dB gains respectively are cascaded. Determine the overall noise figure of the system. [8+8]
8. (a) Explain the characteristics of a matched filter receiver, with necessary equations.  
(b) Write notes on: Noise jamming, Repeater jamming. [8+8]

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1. (a) Describe a pulsed Radar system. Discuss how the direction and range of an object is determined using this system.  
(b) Discuss about the frequencies used for radar. [10+6]
2. (a) Discuss in detail the quantitative analysis of Receiver noise and hence derive the expression for minimum detectable signal.  
(b) Discuss about probability density functions. [10+6]
3. (a) Explain the operation of a FMCW radar when modulation is linear and triangular, and target is assumed to be stationary with the help of neat sketches.  
(b) Explain the need for a bank of narrowband filters in FMCW radar. [10+6]
4. (a) What is meant by shaping the frequency response characteristics of single delay line canceler ? Explain.  
(b) What is an area MTI ? Explain. [8+8]
5. (a) Draw the block diagram of non-coherent MTI Radar and explain the function of each block in detail.  
(b) Give the advantages of non-coherent MTI Radar. [10+6]
6. (a) Compare the tracking techniques.  
(b) Explain in detail about limitations to tracking accuracy. [10+6]
7. (a) List out the general characteristics and requirements of a radar receiver.  
(b) Explain the need for a duplexer and its requirements for a pulsed radar. [8+8]
8. Explain the principle and characteristics of a matched filter. Hence derive the expression for its frequency response function. [16]

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1. (a) Derive the Radar range equation.  
(b) With a block diagram explain the operation of pulse radar. [6+10]
  
2. Write short notes on:
  - (a) Radar cross section of targets.
  - (b) System losses in Radar. [8+8]
  
3. (a) Derive an expression for Range and Doppler measurement for an FMCW Radar.  
(b) Determine the range and Doppler velocity for a FM-CW radar if the target is approaching the Radar. Given the beat frequency  $f_b$  (up) = 20kHz. and  $f_b$ (down) = 30 kHz for the triangular modulation, the modulating frequency is 1MHz and Doppler frequency shift is 1kHz. [10+6]
  
4. (a) Calculate the second blind speed of MTI radar whose operating wave length is 5.0 cm and the pulse repetition frequency is 2000Hz.  
(b) What is staggered PRF? Where and why is it used in a radar system?  
(c) Explain the technique to increase the blind speeds found with MTI radar. [8+8]
  
5. (a) Differentiate the operation of pulse radar from simple cw radar.  
(b) Draw the output waveforms from mixer for the different range of Doppler frequency.  
(c) Draw the different sweeps of an MTI radar on A-scope display. [6+5+5]
  
6. (a) Compare the tracking techniques.  
(b) Explain in detail about limitations to tracking accuracy. [10+6]
  
7. Write short notes on:
  - (a) Aperture illumination and efficiency of radar antennas.
  - (b) Loss in gain of cosecant squared antennas.
  - (c) Beam steering of phased arrays.
  - (d) P - Scope display. [4×4]
  
8. (a) Explain the principle and process of correlation detection.

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**Set No. 3**

(b) Explain and distinguish between different ECCM options. [8+8]

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1. (a) Describe a pulsed Radar system. Discuss how the direction and range of an object is determined using this system.  
(b) Discuss about the frequencies used for radar. [10+6]
2. (a) Explain the significance of probability of false alarm and probability of miss.  
(b) Explain about the Integration of Radar pulses. [8+8]
3. (a) What is the purpose of filter banks in CW Radar receivers. Draw the block diagram of IF Doppler filter bank and draw its frequency response .  
(b) For a given Doppler filter bank ,can the velocity resolution be made smaller by increasing or decreasing the transmitted frequency? Explain your answer. [10+6]
4. (a) Description of Range gate Doppler filters.  
(b) Differentiate blind phases from blind speeds.  
(c) Discuss the application of electrostatic storage tubes in MTI radar. [6+5+5]
5. (a) Differentiate the operation of pulse radar from simple cw radar.  
(b) Draw the output waveforms from mixer for the different range of Doppler frequency.  
(c) Draw the different sweeps of an MTI radar on A-scope display. [6+5+5]
6. (a) Compare the tracking techniques.  
(b) Explain in detail about limitations to tracking accuracy. [10+6]
7. (a) Define the noise figure for a radar receiver, and obtain an expression for the noise figure for 3 networks in cascade.  
(b) Explain the functioning and characteristics of PPI display. [10+6]
8. (a) Explain the characteristics of a matched filter receiver, with necessary equations.  
(b) Write notes on: Noise jamming, Repeater jamming. [8+8]

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