

IV B.Tech I Semester(R05) Regular&Supplementary Examinations, December 2009

RADAR ENGINEERING

(Electronics & Communication Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

**KOTTAM**  
INSTITUTIONS

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. Describe in detail the various system losses that affect the characteristics of the Radar. [16]
3. (a) What is meant by Doppler shift applied to a Radar signal ? What are some of the ways in which it manifests itself? What are its Radar applications?  
(b) Determine the fixed error in the range of a Radio altimeter to achieve a 15% frequency range for a carrier in the 500-5000MHz range.[10+6]
4. (a) Explain the operation of feed forward filter with an example.  
(b) Discuss briefly about relative target velocities which results in zero MTI response. [8+8]
5. (a) Mention the limitations of MTI radar related to clutter parameters.  
(b) Mention the limitations of improvement factor imposed by pulse-to-pulse instability.  
(c) Write short notes on inter clutter visibility. [6+5+5]
6. (a) Compare the tracking techniques.  
(b) Explain in detail about limitations to tracking accuracy. [10+6]
7. (a) Explain the terms: side lobe radiation and aperture efficiency, as applicable to radar antennas.  
(b) Explain the significance and effects of uniform excitation and tapered excitation of parabolic reflectors. [8+8]
8. (a) Explain the characteristics of a cross-correlation receiver with a block diagram.  
(b) Describe and differentiate between active ECM and passive ECM. [8+8]

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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. (a) Define and explain Transmitter power in Radar equation and express the Radar equation in terms of the energy contained in the transmitted waveform.  
(b) Discuss the factors of PRF and range ambiguities. [10+6]
3. (a) Explain how do you distinguish between CW Radar and Pulsed Radar.  
(b) Determine the operating frequency if the target is moving with acceleration as same as acceleration of gravity and the received signal bandwidth is 50Hz. [8+8]
4. (a) Under what conditions could the term blind speed in MTI radar be an embarrassment ? What is a method of overcoming the problems of blind speed in analog radars?  
(b) Give an account on 'Electronic frequency tracking'. [10+6]
5. (a) Mention the limitations of MTI radar related to clutter parameters.  
(b) Mention the limitations of improvement factor imposed by pulse-to-pulse instability.  
(c) Write short notes on inter clutter visibility. [6+5+5]
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) 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. Explain the following:
  - (a) Prediction of range performance
  - (b) PRF and range ambiguities.
  - (c) Transmitter power. [5+6+5]
3. (a) For an unambiguous range of 81 nautical miles(1 nautical mile = 1852 mt) in a two frequency CW radar. Determine  $f_2$  and  $\Delta f$  when  $f_1 = 4.2$  Hz. Derive the expression used to solve this problem.  
(b) Write about the necessity of using filter banks in CW radar receiver system. [10+6]
4. (a) Draw and explain frequency-response characteristics of an MTI using range gates and filters.  
(b) What is the difference between MTI radar using range gates and an MTI with a single-delay-line canceler. [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) Write notes on various antenna parameters and their significance as applicable to radars.  
(b) Explain and distinguish between the branch-type and balanced duplexers. [8+8]
8. (a) Establish the impulse response characteristic for a matched filter.  
(b) Derive the radar range expression in terms of jammer bandwidth and power. [8+8]

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1. (a) Derive the basic Radar equation.  
(b) What are the problems and limitations in the prediction of radar range.  
(c) Discuss about detection of signals in noise. [6+5+5]
2. Discuss in detail the Radar Cross Section of targets and the Cross section fluctuations. [16]
3. (a) Describe different types of measurement errors, derive the expression for quantization error in FMCW Radar.  
(b) A target is receding from a CW Radar transmitter at the rate of 25m/sec. The Radar wavelength is 3cm. Calculate the Doppler frequency shift.  
(c) Distinguish between homodyne and sideland superheterodyne type of CW radar. [6+5+5]
4. (a) Explain the operation of an MTI radar with 2 prfs.  
(b) Draw the block diagram of Range-Rated Doppler Filters and explain. [8+8]
5. Explain the following limitations of MTI radar.  
(a) Equipment instabilities.  
(b) Scanning modulation.  
(c) Internal fluctuation of clutter. [5+5+6]
6. (a) Compare the tracking techniques.  
(b) Explain in detail about limitations to tracking accuracy. [10+6]
7. (a) Explain the terms: side lobe radiation and aperture efficiency, as applicable to radar antennas.  
(b) Explain the significance and effects of uniform excitation and tapered excitation of parabolic reflectors. [8+8]
8. Write notes and explain about:  
(a) Passive ECM  
(b) Matched and non-matched filters  
(c) North filter.  
(d) Antijamming techniques. [4×4]