SET-1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
R05   IV B.Tech. I Semester Supplementary Exams, May/June – 2009
RADAR SYSTEMS

(Common to ECE & ETM)

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions.
All Questions carries equal marks.
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1 a)   Derive the maximum range for a radar system from first principles.
  b)   Explain the applications of radar.   [8+8]

2 a)   Write explanatory notes on:
  i)   Minimum detectable signal
  ii)   False alarm
  iii)   Missed detection.
  b)   Explain the following:
  i)   Pulse repetition frequency
  ii)   Range ambiguities.   [16]

3 a)   For an unambiguous range of 81 nautical miles (1 nautical mile = 1852 m) in a
       two frequency CW radar . Determine f_2 and Δf when f_1 = 4.2 kHz . Derive the
       expression to solve his problem.
  b)   Explain the operation of CW Doppler radar non zero IF with neat block diagram.
                                                                           [10+6]

4 a)   Explain the principle of operation of FMCW altimeter with suitable diagram.
  b)   Explain how the noise signals are limiting the performance of FMCW altimeter.
                                                                           [10+6]

5 a)   Explain the principle of operation of MTI radar with power amplifier transmitter
       with neat block diagram.
  b)   What is butterfly effect? What are its advantages.   [10+6]

6 a)   Compare tracking techniques.
  b)   Explain the principle of operation of phase comparison monopulse tracking radar.
                                                                           [10+6]
7 a)   What is a matched filter receiver? Draw its response characteristics.
  b)   Describe the operation of matched filter with non white noise.   [8+8]

8)   Explain the following:
  i)   Branch type duplexer
  ii)   Balanced type duplexer
  iii)   Receiver protectors.   [16]
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SET-2

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1 a) Obtain the radar equation and discuss various parameters which improve the performance of radar

 b) A pulsed radar operating at 10 GHz has an antenna with a gain of 28dB and a transmitter of 2 KW (pulse power). If it is defined to detect a target with a cross section of 12 sq. m. and the minimum detectable signal is -90 dBm . What is the maximum range of the radar.   [8+8]

2 a) Explain detection of signals in noise.

 b) Describe different noise components present in radar systems.   [8+8]

3 a) Define Doppler effect. Explain how it is used in CW radar

 b) Explain how isolation between transmitter and receiver is obtained in CW radar.
                                                                                                                    [8+8]

4 a) Explain the principle of operation of FMCW altimeter with suitable diagram.

 b) Describe the operation of multiple frequency CW radar.   [10+6]

5 a) Explain the principle of operation of MTI radar with power oscillator transmitter with neat block diagram.

 b) Discuss about blind speeds.   [10+6]

6 a) Explain in detail about the limitations to tracking accuracy.

 b) Explain the operation of amplitude comparison monopulse tracking radar with the help of a block diagram.   [6+10]

7 a) Derive the matched filter characteristic.

 b) Discuss about efficiency of non-matched filters.   [10+6]

8 a) Write notes on various displays.

 b) Explain the operation of branch type duplexer with neat sketch.   [10+6]

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1 a)   Obtain the radar equation and discuss various parameters which improve the performance of radar.
 b)   Draw the simple radar block diagram and explain its operation.   [8+8]

2)   Write explanatory notes on:
      i)   Pulse repetition frequency and range ambiguities
      ii)   System losses.   [6+10]

3 a)   Define Doppler effect. Explain the operation of simple CW radar with block diagram. List its applications.
 b)   Write about the necessity of using filter banks in CW radar receiver.   [10+6]

4 a)   Explain the operation of sinusoidally modulated FMCW radar extracting the third harmonic with neat block diagram.
 b)   Explain the operation of multiple frequency CW radar.   [10+6]

5 a)   Discuss about staggered pulse repetition frequencies.
 b)   Explain the principle of operation of MTI radar using range gates and filters.
                                                                              [8+8]

6 a)   Compare sequential lobing and conical scanning.
 b)   Explain in detail about limitations to tracking accuracy.   [8+8]

7 a)   Derive the matched filter characteristic.
 b)   Discuss about matched filter and correlation function.   [8+8]

8 a)   Write notes on:
      i)   noise figure
      ii)   noise temperature.
 b)   Explain any two types of mixers.   [16]

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1 a)   A pulsed radar operating at 10 GHz has an antenna with a gain of 28dB and a transmitter of 2 KW (pulse power). If it is defined to detect a target with a cross section of 12 sq. m. and the minimum detectable signal is -90 dBm . What is the maximum range of the radar.
  b)   Explain about the applications of radar.   [8+8]

2)   Write explanatory notes on:
  i)   Receiver noise
  ii)   Signal to noise ratio
  iii)   Radar cross section of targets.   [16]

3 a)   Explain the principle of operation of CW Doppler radar with non zero IF receiver.
  b)   Explain the mechanism of finding target direction.   [8+8]

4 a)   Explain how range and Doppler measurements are performed using FMCW radar.
  b)   Discuss about measurement errors.   [8+8]

5)   Write notes on the following:
  i)   Delay line cancellers
  ii)   Blind speeds
  iii)   Clutter attenuation
  iv)   Transversal filters.   [16]

6)   Explain the following:
  i)   Low angle tracking
  ii)   Tracking in range
  iii)   Acquisition.   [16]

7 a)   Derive the equation for impulse response of a matched filter
  b)   Write short notes on
       i)   Efficiency of non matched filters.
       ii)   Matched filter with non white noise.   [8+8]

8 a)   What is low noise front end? What are its applications.
  b)   Explain the following:
       i)   Balanced type duplexer
       ii)   Branch type duplexer.   [8+8]

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