Code No: M0422            **R07**                    | Set No. 1 |

**IV B.Tech. I Semester Regular Examinations, November, 2012**
**Radar Systems**
**(Electronics and Communication Engineering)**

**Time: 3 Hours**                                    **Max Marks: 80**

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

1. a) Define maximum unambiguous range and give procedure to measure it.    [8]
   b) i) What should be the pulse repetition frequency of a radar in order to
         achieve a maximum unambiguous range of 60 nmi?
      ii) How long does it take for the radar signal to travel out and back when
          the target is at the maximum unambiguous range?
      iii) What is the duty cycle of this radar?                            [8]

2. a) Describe clearly prediction of range performance.                     [8]
   b) A radar mounted on an automobile is to be used to determining the
      distance to a vehicle travelling directly in front of it. The radar operate
      at a frequency of 9375 MHz (X band) with pulse width of 10 ns.
      The maximum range is to be 500 ft.
       i) What is the pulse repetition frequency that corresponds to a range of
          500 ft.
      ii) Find the average power required to detect a 10 $m^2$ radar cross section
          vehicle at a range of 500 ft., if the minimum detectable signal is
          5 x $10^{-13}$ W.                                                 [8]

3. a) What is Doppler effect? How do you measure radar range using CW radar.   [8]
   b) With a transmit frequency of 5GHz, calculate the Doppler frequency seen by a
      stationary radar when the target radial velocity is 100 Km/hr. (62.5mph)    [8]

4. a) With a neat sketch explain the function of FM-CW radar.               [10]
   b) Determine the operating frequency if the target is moving with acceleration as
      same as acceleration of gravity and received signal band width is 50GHz.    [6]

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5. Write short notes on the following.
   a) Delay line canceller       b) Limitations to MTI Performance       [8+8]

6. Discuss different radar tracking methods.       [16]

7. Write about how does matched filter receiver can be designed and give any two applications.       [16]

8. Write short notes on the following.
   a) Phased array antennas
   b) Display types       [8+8]

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**IV B.Tech. I Semester Regular Examinations, November, 2012**
**Radar Systems**
**(Electronics and Communication Engineering)**
**Time: 3 Hours** **Max Marks: 80**

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

1. a) Explain the operation of a pulse radar with block diagram. [8]
   b) A VHF radar at 220MHz has a maximum unambiguous range of 180nmi
      i) What is its first blind speed (in knots).
      ii) Repeat, but for an L-band radar at 1250MHz. [8]

2. a) Explain why integration of pulses is needed while operating a radar. [8]
   b) Determine the significance of radar cross section for a given target. [8]

3. a) Write the application and limitations of continuous wave (CW) radar. [8]
   b) Explain about Doppler effect and how it helps in the working of CW
      radar with block diagram. [8]

4. Write short notes on
   a) FM- CW altimeter
   b) Multiple Frequency CW radar [8+8]

5. a) Explain the filter characteristics of MTI radar. [8]
   b) Write short notes on the following.
      i) Antennas of radar            ii) Blind speeds [4+4]

6. a) Write short notes on sequential lobing. [6]
   b) Write briefly about MTI improvement factor [6]
   c) Write about transversal filter [4]

7. Derive the impulse response of a matched filter using in radar receiver. [16]

8. a) Why does a parabolic surface make a good reflector antenna. [6]
   b) Write about phased array antennas in detail. [10]

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# R07

**Set No. 3**

### IV B.Tech. I Semester Regular Examinations, November, 2012
### Radar Systems
#### (Electronics and Communication Engineering)

**Time: 3 Hours**                                                                **Max Marks: 80**

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

1. a) Derive basic radar equation and explain each parameter significance. [8]
   b) What is peak power of radar who's average transmitter power is 200W.
      pulse width of 1µs and a pulse repetition frequency of 1000Hz. [8]

2. a) Define the following.
      i) Minimum detectable signal. [4]
      ii) Receiver noise. [4]
   b) A radar has a bandwidth b = 50 KHz and average time between false alarms of
      10 mins.
      i) What is probability of false alarm
      ii) What is the pulse width that results in a minimum range of 15nmi. [8]

3. a) How do you provide isolation between transmitter and receiver. Discuss various
      aspects. [8]
   b) Discuss applications of CW radar. [8]

4. With a neat sketch explain the operations and applications of FM-CW altimeter. [16]

5. How do you narrate the principle concept and approach for different applications
   using MTI radar [16]

6. Write in brief about the following.
   a) Sequential Lobing [8]
   b) Acquisition [8]

7. Write short notes on
   a) Matched filter receiver
   b) Correlation detection

8. What are the different aspects of the following displays explain clearly. [4+4+4+4]
   a) A "Scope"             b) C "Scope"
   c) PPI "Scope'           d) L "Scope"

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# R07

**Set No. 4**

### IV B.Tech. I Semester Regular Examinations, November, 2012
## Radar Systems
### (Electronics and Communication Engineering)

**Time: 3 Hours**                                                        **Max Marks: 80**

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

1.  a) What are the different bands of radar frequencies and their applications. [8]
    b) Why can't the altitude line in a high PRF pulse Doppler radar be eliminated
       by range gating rather than by filtering. [8]

2.  a) Explain how system losses will effect the radar performance. [8]
    b) A VHF radar at 220MHz has a maximum unambiguous range of 150nmi
       i) What is its first blind speed (in knots).
       ii) Repeat, but for an L-band radar at 1250MHz. [8]

3.  a) What is the effect of receiver bandwidth on the maximum range of a well
       designed radar, assuming the average power remains constant. Give explanation. [8]
    b) A radar at a frequency of 1.35 GHz has an antenna of a width D=32 ft., a
       maximum unambiguous range of 220nmi and an antenna scan time
       (time to make 1 rotation of the antenna) of 10 sec. What is the integration of loss and
       integration improvement factor when the probability of the detection is 0.9 and
       probability of false alarm is $10^{-4}$. [8]

4.  a) Explain the differences between CW radar and multiple frequency CW radar. [6]
    b) Explain the working of approaching targets FMCW radar with neat waveforms. [10]

5.  a) Explain about non-coherent MTI radar. [6]
    b) Write short notes about [10]
       i) Area of MTI
       ii) Adaptive MTI

6.  a) List the limitations of tracking accuracy. [8]
    b) Compare different types of tracking techniques. [8]

7.  a) Write briefly about the efficiency of non matched filters [10]
    b) Write short notes on cross correlation receiver [6]

8.  a) Write short notes on beam steering. [6]
    b) Explain how scanning is performed with a pencil beam source up on the
       phased array antenna design. [10]

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