15EC833

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Eighth Semester B.E. Degree Examination, June/July 2024
Radar Engineering

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. With neat block diagram explain conventional pulse radar with a super heterodyne receiver. **(08 Marks)**

   b. A ground based air-surveillance radar operates at frequency of 1300 MHz (L band). Its maximum range is 200nmi for the detection of a target with a radar cross section of one square meter ($\sigma = 1m^2$). Its antenna is 12m wide by 4m high, and the antenna aperture efficiency is $\rho_a = 0.65$. The receiver minimum detectable signal is $S_{min} = 10^{-13}$W. Determine the following :
   - i) Antenna effective aperture A_e (square meters) and antenna gain G in numerically and decibel.
   - ii) Peak transmitter power.
   - iii) Pulse repetition frequencies to achieve a maximum unambiguous range of 200nmi.
   - iv) Average transmitter power, if the pulse width is 2µs.
   - v) Duty cycle
   - vi) Horizontal beam width (in degrees). **(08 Marks)**

OR

2   a. Briefly describe the major areas of radar applications. **(08 Marks)**

   b. Compute the following related to radar:
   - i) What should be the pulse repetition frequency of a radar in order to achieve maximum unambiguous range of 60nmi?
   - 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) If radar has a peak power of 800kW, what is its average power? Choose pulse width 1.5µs. **(03 Marks)**

   c. Explain basic principle of RADAR with neat block diagram. **(05 Marks)**

Module-2

3   a. Describe the different noise components present in radar systems. **(07 Marks)**

   b. Discuss various system losses in radar system. **(04 Marks)**

   c. Describe briefly range ambiguities in radar system. **(05 Marks)**

OR

4   a. Define Radar Cross Section (RCS)? State its properties and its expression. **(06 Marks)**

   b. L band radar operating at 1.25GHZ used a peak pulse power of 3MW and must have a range of 185.2Km for objects whose radar cross section is $1m^2$. If P_{min} is 2×10^{-13} watt. What is the smallest diameter the antenna reflector could have, Assuming it to be full paraboilid with $\eta = 0.65$. **(06 Marks)**

   c. What are the roles of threshold in deciding minimum detectable signal? **(04 Marks)**

Module-3

5 a. With a neat block diagram, explain simple CW Doppler radar. Also mention the advantages and disadvantages. **(08 Marks)**

   b. Explain with a neat block diagram the working of a digital MTI doppler signal processor. **(08 Marks)**

OR

6 a. With a block diagram, explain the working of MTI radar with power amplifier transmitter. **(08 Marks)**

   b. With a neat block diagram, explain Moving Target Detector [MTD]. **(08 Marks)**

Module-4

7 a. Define monopulse tracker. Using block diagram, explain amplitude comparision monopulse tracking radar in on one angle coordinates. **(08 Marks)**

   b. With neat block diagram, explain conical scan tracking radar. **(08 Marks)**

OR

8 a. Discuss the concept of phase comparison monopulse. **(08 Marks)**

   b. Compare monopulse and conical radar tracking system. **(08 Marks)**

Module-5

9 a. Explain various antenna parameters. **(04 Marks)**

   b. Explain various Reflector antennas and its feeding technique. **(08 Marks)**

   c. Give differences between series and parallel feed. **(04 Marks)**

OR

10 a. Write short notes on :
   i) Deflection modulation/A – Scope   ii) Intensity modulation/PPI. **(08 Marks)**

   b. Write characteristics and requirement of Radar Receiver. **(08 Marks)**

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