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17EC833

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Radar Engineering

Time: 3 hrs.

Max. Marks: 100

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

Module-1

1   a. Explain a conventional pulse radar with super heterodyne receiver with a neat diagram. **(10 Marks)**

    b. A 10GHz radar has the following characteristics,
       Peak transmitted power P_t = 250KW
       Power gain of the antenna G = 2500
       Minimum detectable peak power by receiver S_{min} = 10^{-14}w
       Radar cross section of target, σ = $2m^2$
       Radar cross sectional area A_e = $10m^2$
       Find the maximum range. **(06 Marks)**

    c. List the applications of radar. **(04 Marks)**

OR

2   a. Define the following terms used in radar :
       i)   Maximum unambiguous range
       ii) Average power
       iii) Peak power
       iv) Duty cycle
       v)   PRF. **(10 Marks)**

    b. Compute the following related to radar :
       i)   What should be the PRF of a radar 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 the average power? Choose pulse width of 1μs. **(06 Marks)**

    c. Explain with neat diagram, basic principle of radar. **(04 Marks)**

Module-2

3   a. Discuss with equation, the probability of false alarm and probability of detection using an envelope detector. Draw the block diagram. **(10 Marks)**

    b. With a note on PRF and range ambiguity with necessary waveforms. **(10 Marks)**

OR

4   a. Briefly explain the plumbing loss and antenna losses in radar. **(10 Marks)**

    b. Explain briefly, the following radar cross section of the targets :
       i) Sphere   ii) Cone sphere. **(10 Marks)**

Module-3

5   a. With neat block diagram, explain how the Doppler frequency is extracted from CW and pulse Doppler radar. **(10 Marks)**

    b. With a block diagram, explain working MTI radar. **(10 Marks)**

OR

6 a. Define blind speed, UHF radar at 220MHz has a maximum unambiguous range of 180nmi
      i)   What is the first blind speed
      ii) Repeat, but for an L-band radar at 1250 MHz
      iii) Repent, but for an X-band radar at 9375MHz.   **(06 Marks)**
   b. Explain the working of moving target detector with neat diagram.   **(08 Marks)**
   c. Derive the equation for the frequency response of single delay line canceller.   **(06 Marks)**

Module-4

7 a. Discuss various types of tracking radar systems.   **(06 Marks)**
   b. Define monopulse tracker. Using block diagram, explain amplitude comparison monopulse traking radar in one angle coordinate.   **(08 Marks)**
   c. Discuss the concept of phase comparison monopulse.   **(06 Marks)**

OR

8 a. Compare monopulse and conical scan radar.   **(06 Marks)**
   b. Explain with a neat block diagram, conical scanning radar.   **(08 Marks)**
   c. Discuss on tracking in range in tracking radar.   **(06 Marks)**

Module-5

9 a. Explain the working of balanced duplexer with neat diagram.   **(10 Marks)**
   b. Write short notes on different types of radar displays.   **(10 Marks)**

OR

10 a. Write short notes on reflector antenna.   **(08 Marks)**
   b. What are the functions of radar antenna?   **(06 Marks)**
   c. Explain the following antenna parameters :
      i)   Directive gain
      ii) Power gain
      iii) Effective aperture.   **(06 Marks)**

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