

Ref No . Ex/ET/T/425D/2018

B.ETCE 4th year 2nd Semester Examination 2018

Radar and Navigation Elect -II

Time : Three Hours

Full Marks : 100

Answer any four questions (from Q1. to Q.5).

Q1 to Q4 has two choices, answer any one of them.

Q.1

- a. What are the difference with conical scan and sequential lobbing? 10
- b. Describe the operation of three channel monopulse RADAR for boresight detection. 10
- c. What is phase comparison monopulse ? 5

Or

Q.1

- a. Describe the operation of Magic TEE in construction of monopulse comparator 10
- b. What is the monopulse tracking principle? Why amplitude comparison monopulse is preferred over phase comparison monopulse? 5+5=10
- c. What is the significance of difference signal in monopulse tracking? What is the typical level of difference signal at the crossover peak of sum signal? 2+3= 5

Q.2

- a. Why pulse compression is required? A RADAR transmits a 3.5 microsecond pulse at 5.70 GHz with a bandwidth of 4 MHz . The PRF is 550pps and 64 pulses processed together. Its antenna beamwidth is 1.2° . Find how target is spaced from one another at a range of 20Km. 6+6=12
- b. Draw the conjugate filter based pulse compression radar and explain the same. 8
- c. Draw and briefly explain the block diagram of Linear frequency modulation is pulse compression radar. 5

Or

[Turn over

Q.2

a. Deduce Ambiguity diagram expression. Describe the ambiguity diagram of general case. What happen in ambiguity diagram if the ideal spectrum component has several harmonics?

6+ 4+6= 16

b. Explain the operation of sweep to sweep subtraction method for MTI RADAR with block diagram of single delay line canceller

9

Q. 3

a. What is probability of false alarm and threshold detection? Define Radar range equation in terms of receiver noise and transmitter power separately

6+ 6+6= 18

b. A RADAR has a bandwidth 50KHz and an average time between false alarm of 10 min. Hence what is the probability of false alarm?

4

c. The average time between the false alarm is 30 min and the receiver bandwidth is 0.4MHz. What is the threshold to noise ratio?

3

Or**Q.3**

a. Deduce the RADAR range equation. What is the ambiguity between antenna parameter in RADAR range equation?

8+4=12

b. How multiple time around echos can be determined by varying PRF.

6

c. What are RADAR system losses, describe each components?

7

Q. 4

a. What is delay line canceller and explain the frequency response of the same.

3+7=10

b. What is blind speed? What is the highest frequency of the RADAR can be operated if it is required to have a maximum unambiguous range of 200nmi and no blind speed less than 600kt.

4+ 5= 9

c. Show that the product of the maximum unambiguous range and the first blind speed v_1 is equal to $c\lambda/4$ where c is the velocity of propagation and λ is the radar wavelength

6

Or

Q. 4

- a. Explain the operation of pulsed Doppler RADAR by leading and trailing edge concept. **10**
- b. Explain the operation of each block in a pulsed RADAR. **8**
- c. Describe the matched filter frequency response. **10**

Q. 5.

- a. What is a correlation Receiver? How a rectangular pulse can be approximated in matched filter? **5+5=10**
- b. Explain the operation of envelop detector. How it is different with I,Q detection? **5+5=10**
- c. Find the matched filter frequency response function $H(f)$ for a perfectly rectangular video pulse of duration τ and amplitude A . (pulse time duration is from $-\tau/2$ to $\tau/2$). Sketch its magnitude $H(f)$ for positive frequencies. What will be the output of video matched filter?

Take $t_m = 0$

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