53 (EC 810) RENS

2019

RADAR AND ELECTRONIC NAVIGATION SYSTEMS

Paper : EC 810

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions :* 5×20=100

1. 5+7+3+5

(a) Prove that the Doppler frequency shift for a target moving with radial velocity $\frac{dR}{dt}$ is given by $f_d = \pm 2\left(\frac{dR}{dt}\right)\Big/\lambda$, where λ is the wavelength of the radar.

(b) Draw the block diagram of a CW Doppler radar with zero IF receiver and explain its operation.

Contd.

(c) Discuss about the isolation required between the transmitter and receiver for a given application.

(d) Discuss the applications of CW radars.

2. 10+10

(a) What are the main problems of CW Doppler radar with zero IF receiver? Clearly discuss with necessary block diagram, how are they overcome using non-zero IF receiver?

(b) Deriving the necessary equation show that the range of the target can be improved by using two closed frequencies rather than a single frequency.

3. 10+10

(a) What is the main problem of CW Doppler radar and how it can be overcome using FM-CW radar with linear frequency modulation?

(b) Deducing the range equation $R = \frac{C f_r}{4 f_m \Delta f}$ (where the symbols have their usual meanings), clearly explain the range measurement method for a stationary target using triangular frequency modulation in FM-CW radar.

4. 10+10

(a) With the help of block diagram clearly explain the working principle of a FM-CW altimeter using superheterodyne receiver.

(b) What are the different types of measurement errors in radar altimeters? Discuss each of them.

5. 4+8+8

(a) What are the basic differences between the Pulse Doppler radar and MTI radar?

(b) Discuss the basic operation of Pulse Doppler radar using the block diagram.

(c) Draw the block diagram of an MTI radar with power amplifier transmitter and explain its operation.

6. 7+9+4

(a) Derive the expression of the single delay line canceller in connection with MTI radar.

(b) What is meant by blind speeds and how the problem related to blind speeds can be minimized using staggered pulse repetition frequencies ?

(c) In an MTI radar the pulse repetition frequency is 200*Hz* and the carrier transmission frequency is 100*MHz*. Find the first and second blind speeds.