53 (EC 810) RENS

2014

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.*

1. *(a)* Show that two targets located at ranges 'R_1' and 'R_2' can be resolved exactly if the range resolution is given by $\Delta R\Big|_{min} = \frac{C}{2B}$; where '$B$' is the radar's bandwidth. 10

   (b) Discuss the operation of a pulse-doppler radar. 10

2. *(a)* Show that for a CW radar (Doppler) ; the output taken from the mixer/detector will be given by $\frac{A}{2} cos\left[\frac{4\pi}{\lambda}\frac{dR}{dt}\right]$; where the symbols have their usual meaning. 10

(b) Prove that the Doppler frequency for a target moving with a radial velocity $\frac{dR}{dt}$ will be given by $f_d = \pm\frac{2}{\lambda}\left(\frac{dR}{dt}\right)$; where 'λ' is radar wavelength. 10

3. Deduce the radar range equation given by $R_{max} = \left[\frac{P_T.G.\sigma.Ae}{(4\pi)^2 S_{min}}\right]^{1/4}$; where the symbols have their usual meaning. 20

4. *(a)* Show that a single delay line is equivalent to a high-pass filter. How this delay can be achieved in a radar-based system ? 10

(b) A certain radar has a bandwidth of $0{\cdot}4MHz$ and the average time between false alarm is $30min$. What is the probability of false alarm and the threshold-to-noise power ratio ? 6

(c) What methods are available for reducing the detrimental effects of blind speed ? 4

5. Show that the effect of multipath propagation on radar range equation is to change the return power dependance on range to R^{-8} rather than R^{-4} relationship found in free space. 20

6. (a) What is an analytic radar signal ? How does it differ from a real radar signal ? 6+4

(b) Find the response of an analytical network fed by an analytical input. 10

7. Write short notes on ***any one*** of the following : 20

(i) Matched filter SNR

(ii) Single-pulse radar ambiguity function.
