BT-8/D-13   **8811**

RADAR ENGINEERING

ECE-404-E

Time : Three Hours]   [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) With the help of a block diagram, describe the operation of a pulse radar system.   **8**

    (b) A radar has a bandwidth B = 50 kHz and an average time between false alarms of 10 min.

        (i)   What is the probability of false alarm ?

        (ii) If the pulse repetition frequency were 1000 Hz and if first 15 nmi of range were gated out because of the use of a long pulse, what would be the new probability of false alarm ?

        (iii) What is the pulse width that results in a minimum range of 15 nmi ?   **6**

(c) Why does the cross section of a complex target fluctuate rapidly with a small change in aspect angle when the radar wavelength is small compared to the target's dimensions ?　　6

2. (a) Explain the following losses occurring in a radar system :　　3+4+4

   (i) Microwave Plumbing Losses

   (ii) Antenna Losses

   (iii) Signal Processing Losses.

   (b) Describe the chief characteristic of the radar echo from a target when its radar cross section is in the (i) Rayleigh region, (ii) Resonance region, and (iii) Optical region.　　9

Unit II

3. (a) With the help of a diagram, describe the principle of multiple frequency CW radar.　　10

   (b) Explain, how the multiple waveforms with different pulse repetition frequencies can be employed for detection of moving targets. Describe the staggered prf method in detail.　　10

4. (a) Describe various factors responsible for degradation in performance of MTI radar system. **10**

(b) What are the problems associated with an MTI system, which need to be addressed, when the radar is mounted on a moving platform? Describe the principle of compensation for Clutter Doppler Spread. **10**

Unit III

5. (a) Discuss various types of tracking radars by explaining their principles of operation. **8**

(b) Draw the block diagram of conical-scan tracking radar and explain its working. Why is the conical scan tracker preferable over the sequential lobing, or lobe switching, tracker ? **12**

6. (a) Explain the principle of closed loop automatic tracking system. What methods are generally used to overcome the range glint problem ? **12**

(b) Explain the methods used for reducing multipath effects at low angles in tracking radars. **8**

Unit IV

7. (a) Define Noise Temperature. Derive an expression for the effective noise temperature of a receiver consisting of a number of networks in cascade. 8

   (b) What are the limitations in using an all-solid state duplexer in a radar receiver ? 6

   (c) Compare the use of double-conversion superheterodyne receiver and single-conversion receiver for radar systems. 6

8. (a) With the help of a suitable diagram, explain the principle of balanced duplexer used for preventing damage to the radar receiver. 10

   (b) Explain various standard types of display presentations used by radar receivers. 10