Subject: RADAR AND NAVIGATIONAL AIDS

Time: 3 Hours **JUNE 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. The average power of radar is equal to:

. **(A)** $P_t \times PRF$ **(B)** $P_t \times$ duty cycle
(C) $P_t \times PRP$ **(D)** P_t /duty cycle

b. Radar range R is equal to:

(A) $C \times \Delta t$ **(B)** $\Delta t/2$
(C) $P_t \times \Delta t/2$ **(D)** $C \times \Delta t/2$

c. The nominal frequency range of C-band radar is:

(A) 4-8 GHz **(B)** 1-2 GHz
(C) 8-12 GHz **(D)** 2-4 GHz

d. The maximum unambiguous radar range is:

(A) 2C×PRP **(B)** PRF/ C
(C) C/2 PRF **(D)** 2C/ PRF

e. The radar system losses depend upon:

(A) Antenna losses **(B)** Plumbing losses
(C) Signal processing losses **(D)** All of the above

f. The purpose of delay line is to produce a delay equal to:

(A) PRF **(B)** PRP
(C) Blind speed **(D)** None of the above

g. The blind speed in radar are eliminated by using:

(A) Delay line cancellers
(B) Staggered PRF
(C) Doppler shift
(D) Single PRF

h. Tracking in range is achieved by:

(A) Range gate stealer **(B)** Split gates
(C) Automatic tracking **(D)** Beam switching

i. AFC system is employed to keep:

(A) Receiver in tune with transmitter
(B) Frequency agility
(C) Constant gain
(D) Volume control

j. The device used to protect receiver when the radar transmitter is transmitting:

(A) Modulator **(B)** Mixer
(C) Duplexer **(D)** Magnetron

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Describe the operation of Pulse Radar with help of block diagram. **(8)**

b. Derive the simple form of the radar range equation. **(8)**

Q.3 a. Briefly describe the behaviour of the radar cross section **(4)**

b. Derive an expression for echo power in consecant-squared antenna for an air-surveillance radar. **(4)**

c. Briefly explain various Radar System Losses **(8)**

Q.4 a. Describe Doppler Frequency shift **(4)**

b. A C W radar transmits frequency of 10 GHz and Doppler is 1000 Hz. Calculate the radial velocity of the target. **(4)**

c. Explain with the help of block diagram, the principal of operation of MTI radar. **(8)**

Q.5 a. Describe Matched Filter Receiver. List its important characteristics. **(**

b. Enumerate the important parameters for the automatic detection of radar signal. **(8)**

Q.6 a. Briefly explain radar clutter, surface clutter, volume clutter. **(8)**

b. Explain variation of surface clutter with grazing angle with the help of suitable diagram. **(8)**

Q.7 a. Explain Directive gain and Power gain in radar antenna. **(8)**

b. Enumerate the advantages of electronically steered phased array antenna. **(8)**

Q.8 a. Explain the role and design features of RF low noise amplifier. **(6)**

b. Define Noise Figure and express it mathematically? **(6)**

c. Briefly explain Circulator as Duplexer. **(4)**

Q.9 a. Briefly explain different types of tracking radars? **(8)**

b. Briefly explain the principal of operation of three types of Radar/Radio Beacons. **(8)**