

AMIETE – ET (NEW SCHEME)

Time: 3 Hours

JUNE 2012

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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. A radar that increases its prf high enough to avoid the problems of blind speeds is called

- (A) Air surveillance radar (B) Pulse doppler radar
(C) MTI radar (D) High prf tracking radar

b. The deflection of the beam or the appearance of an intensity-modulated spot of a radar display caused by the presence of a target is referred to as

- (A) Blip (B) Glint
(C) Scintillation (D) amplitude fluctuation

c. The standard LORAN operates in the frequency range of _____ and the low frequency version of LORAN operates at _____.

- (A) 1.8 to 2 M cycles, 100K cycles (B) 10K cycles, 1.75 to 2 M cycles
(C) 1.75 to 2 M cycles, 10K cycles (D) 100K cycles, 1.8 to 2M cycles

d. Loss caused by not tracking at the peak of the antenna gain

- (A) Cross over loss (B) Polarization loss
(C) Sqint loss (D) Integration loss

e. Air port surface detection equipment has the specialized surface search task of keeping track of air craft on the ground at air ports .The PRF used here is

- (A) High PRF (B) Medium or Low PRF
(C) Medium PRF (D) Low PRF

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- f. Method of enhancing cross-range resolution, that takes advantage of differential Doppler shifts, from objects at different positions within the angular resolution cell is
- (A) SAR
 (B) Doppler Beam Sharpening (DBS)
 (C) Inverse Doppler Beam Sharpening (IDBS)
 (D) ISAR
- g. A balanced duplexer used in Radar is a popular form of duplexer with good power handling capability _____
- (A) Narrow bandwidth (B) High bit rate
 (C) Low bit rate (D) Wide bandwidth
- h. An Envelope Detector requires that the video band width B_v and the IF center frequency f_{if} . These conditions are usually met in radar for
- (A) $B_v \leq B_{if}/2$; $f_{if} = B_{if}$ (B) $B_v \geq B_{if}/2$; $f_{if} \geq B_{if}$
 (C) $B_v \geq B_{if}/2$; $f_{if} > B_{if}$ (D) $B_v \geq B_{if}/2$; $f_{if} \gg B_v$
- i. When the phase between the Doppler signal and the sampling at the prf results in zero loss, it is called _____
- (A) Straddling loss (B) Blind phase
 (C) Doppler effect (D) System losses
- j. _____ which uses the locations of the target measured over a period of time to establish the track/path of the target
- (A) Digital scanning radar (B) MTI radar
 (C) Automatic tracker (D) Search radar

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

- Q.2** a. What are the frequencies used in radar applications in electromagnetic spectrum? (6)
- b. With a neat block diagram explain the function of a typical radar. (6)
- c. Write a note on the applications of radar. (4)
- Q.3** a. Derive an expression for maximum range of a radar. It should include the band width and the receiver noise figure also. (8)

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- b. Calculate the maximum range of radar system which operates at 3.5 cms wave length, with a peak pulsed power of 500 kw. If its minimum receivable power is 10^{-13} Watts, the capture area of the antenna is 8 m^2 and radar cross sectional area of the target is 25 m^2 . (8)
- Q.4** a. Draw a neat diagram of MTI radar and explain its operation. (6)
- b. An MTI radar operates at 4 GHz with a pulse repetition frequency of 800 pulses per sec. Calculate the lowest three blind speeds. (6)
- c. Write a note on delay line cancellers. (4)
- Q.5** a. With a continuous wave transmitter of 5 GHz, calculate the Doppler frequency seen by a stationary radar when the target radial velocity is 100 km/hr{62.5mph}. (6)
- b. Define clutter. Derive radar range equation for the detection of a target in surface clutter at low grazing angles. (10)
- Q.6** a. Briefly explain the functions of a Radar Antenna and its parameters. (8)
- b. With mathematical steps and suitable diagram explain electronically steered phased array antenna and their chief advantages in radar. (8)
- Q.7** a. With a block diagram explain the different types of duplexers and their uses. (8)
- b. Calculate the minimum power of the received, detectable signal for a radar receiver which has an IF band width of 1.5 MHz and a 9 dB noise figure. (8)
- Q.8** Write an explanatory note on the following:
- (i) Tracking radar
 - (ii) Radar Beacons and their applications
 - (iii) Radio direction finding
 - (iv) Air craft landing system. (4×4)
- Q.9** a. With the help of a neat diagram, explain the performance of mixer in a radar receiver. (8)
- b. Derive an equation for probability of false alarm in terms of false alarm time. (8)