

**AMIETE – ET (Current & New Scheme)**

Time: 3 Hours

**June 2019**

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. In case the antenna diameter in a radar system is increased by a factor of 2.5, the maximum range will  
(A) increase 5.25 times                      (B) increase 2.5 times  
(C) increase by 0.5 times                      (D) reduce to half
- b. The major advantage of pulsed radar over CW radar is that  
(A) pulsed radar readily gives the range of target while CW radar cannot give range information  
(B) pulsed radar can identify a target more easily than CW radar  
(C) pulses get reflected from the target more efficiently as compared to CW waves  
(D) None of these
- c. The output tube for a pulsed radar system may be a  
(A) magnetron                                      (B) klystron  
(C) travelling wave tube                      (D) Any of these
- d. Radar detection is limited to line-of-sight because  
(A) of curvature of the earth  
(B) the waves are not reflected by the ionosphere  
(C) long wavelengths are used  
(D) None of these
- e. In radar system, clutter is  
(A) identification of objects moving at high speeds  
(B) identification of objects at low speeds  
(C) echoes corresponding to stationary targets  
(D) jamming of radar due to simultaneous spotting of two targets
- f. The sensitivity of a radar receiver is ultimately set by  
(A) high SN ratio                                      (B) lower limit of useful signal input  
(C) overall noise temperature                      (D) All of these

- g. In a radar receiver the IF amplifier is usually  
 (A) broad band to permit the use of wide pulses  
 (B) broad band to permit the use of fairly narrow pulses  
 (C) narrow band in order to use narrow pulses  
 (D) narrow band in order to use wider pulses
- h. After a target has been acquired, the best scanning system for tracking will be  
 (A) Spiral (B) Helical  
 (C) Nodding (D) Conical
- i. A 'RADOME' is a  
 (A) dome shaped radar antenna (B) protective cover for the antenna  
 (C) radar housed in a dome (D) dish shaped radar antenna
- j. LORAN uses  
 (A) two radars (B) homing path  
 (C) localizer and glide path (D) master and slave stations

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

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- Q.2** a. With neat block diagram, explain the working of radar. (8)
- b. Derive the simple form of the radar equation. (8)
- Q.3** a. Describe, how threshold level for detection is decided in the presence of receiver noise for a specified probability of occurrence of false alarms by applying statistical noise theory? (8)
- b. Describe briefly the behaviour of the radar cross section (in the microwave region) of a raindrop and a large aircraft with respect to its dependence on (i) frequency and (ii) viewing aspect. (8)
- Q.4** a. Explain the working of MTI radar with neat block diagram. (8)
- b. Explain the working of the original Moving Target Detector signal processor with neat block diagram. (8)
- Q.5** a. (i) Find the matched-filter frequency response function  $H(f)$  for a perfectly rectangular (video) pulse of duration  $\tau$ , and amplitude  $A$ . (Assume the pulse extends in time from  $-\tau/2$  to  $+\tau/2$ ).  
 (ii) Sketch (roughly) its magnitude  $|H(f)|$  for positive frequencies. (8)
- b. Briefly explain the various types of detectors used in radar receivers. (8)

- Q.6** a. What do you understand by the term clutter? List the different types of clutter (names only) and explain detection of target in sea clutter? (8)
- b. Derive and explain Surface-Clutter Radar Equation. (8)
- Q.7** a. List the functions of radar antenna. (4)
- b. Explain about aperture blocking and mitigation techniques. (6)
- c. Explain about the operation of Cassegrain Antenna with diagram. (6)
- Q.8** a. (i) Find the overall noise figure of a super-heterodyne receiver consisting of a low-noise RF amplifier with noise figure of 1.4 dB and gain of 15 dB, a mixer with 6.0 dB conversion loss and noise-temperature ratio of 1.2 and an IF amplifier with a noise figure of 1.0 dB.
- (ii) What would be the noise figure of the receiver in (i) if the RF low-noise amplifier had a gain of 30 dB instead of 15 dB? (8)
- b. Explain the working of Plan Position Indicator. (8)
- Q.9** a. Explain the use of hybrid junctions in monopulse radar. (8)
- b. Explain the working of Instrument Landing System with neat block diagram. (8)