

AMIETE – ET (Current Scheme)

Time: 3 Hours

DECEMBER 2015

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. Determine the maximum unambiguous range and range resolution of a pulse radar having pulse width $5\mu\text{s}$ at a PRF of 1000Hz.

(A) 150 km & 7.5 m	(B) 15 km & 75 m
(C) 1.5 km & .75 m	(D) 150 km & 750 m
- b. A MTI radar is operating at PRF of 1 KHz, find the lowest blind speed. If it is operating at 2 cm wavelengths.

(A) 34 km/hr	(B) 35 km/hr
(C) 36 km/hr	(D) 37 km/hr
- c. The ability of radar to detect wind motion with thunderstorms clouds is due to _____.

(A) Satellite	(B) Reflectivity
(C) Doppler	(D) Cell phone
- d. The clutter power varies _____.

(A) Inversely as the square of the range	(B) Directly as the square of the range
(C) Inversely as the cube of the range	(D) Directly as the cube of the range
- e. As range increases from the radar site, the radar beam tends to climb to higher elevations due to _____.

(A) Earth curvature	(B) Elevation angle that beam is emitted
(C) Both (A) & (B)	(D) None of these
- f. Reflectivity from buildings and objects at the earth surface that are picked up usually closed to radar site are referred to as _____.

(A) Ground clutter	(B) UFO
(C) Clear air returns	(D) Doppler aliasing
- g. The resolution of radar data _____ with distance away from the radar site.

(A) Increases	(B) Decreases
(C) Constant	(D) None of these
- h. An altimeter is basically a _____.

(A) CW Radar	(B) FM Radar
(C) Doppler Radar	(D) None of these

Code: AE78

Subject: RADAR AND NAVIGATIONAL AIDS

- i. Radar receives an echo from a target 20 μ s after sending the signal. The approximate range of the target is _____.
- (A) 300 m (B) 3000 m
(C) 600 m (D) 6000 m
- j. The altitude of a heavenly body is measured in which system of coordinates?
- (A) The terrestrial system (B) The equatorial system
(C) The celestial system (D) The horizon system

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

- Q.2** a. Draw the block diagram of radar and explain the working of its each block. (10)
b. What is meant by maximum unambiguous range & range to a target? (6)
- Q.3** a. Derive an equation to show the relationship between maximum radar range and antenna gain. (8)
b. List and explain some system losses. (8)
- Q.4** a. What are the differences between MTI radar and pulse Doppler radar? What are the limitations to MTI performance? (8)
b. Draw the block diagram of delay line canceller and explain how it works. (8)
- Q.5** a. Summarize the characteristics of the matched filter for an input signal $s(t)$. (8)
b. How the automatic detection of radar signals achieved and by what means it is different from conventional detection method? (8)
- Q.6** a. What do you understand by term clutter? Enlist the different types of clutter (names only) and explain detection of target in sea clutter? (8)
b. Derive the radar equation for detection of target in rain. (8)
- Q.7** a. Enlist all the important functions of radar antenna. (4)
b. When the beam of a phased array antenna is electronically steered to an angle θ_0 from broadside, show that its beam width varies inversely as $\cos \theta_0$. (8)
c. Write a short note on the following antenna parameters: (Any two) (4)
(i) Effective aperture
(ii) Antenna radiation pattern
(iii) Power gain
- Q.8** a. What are the advantages of duplexer and receiver protector? Also, explain the working of balanced duplexer. (10)
b. Enlist different types of mixers used in radar receiver. Explain how mixer works in superheterodyne receiver? (6)
- Q.9** a. What are the benefits of tracking radar? How many types of radar that can track the target? Explain in brief. (10)
b. What is conical scan and sequential lobing? (6)