ROLL NO. _____

**Code: AE78/AE126** **Subject: RADAR AND NAVIGATIONAL AIDS**

## AMIETE – ET (Current & New Scheme)

**Time: 3 Hours** **JUNE 2017** **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**

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

a. The radar cross section of a sphere is a function of its _____ measured in wavelengths.
**(A)** circumference **(B)** frequency
**(C)** diameter **(D)** None of these

b. With the 10 GHz radar if the antenna diameter is 2m the beam width of the antenna of the radar will be
**(A)** 2 degree **(B)** 1 degree
**(C)** 5 degree **(D)** None of these

c. Doppler radar indicates
**(A)** range of target **(B)** range of target and velocity
**(C)** only velocity **(D)** None of these

d. Tracking of radar means tracking of
**(A)** target range **(B)** Doppler frequency
**(C)** Moving targets **(D)** All of these

e. The place of usual radar frequency band in EM spectrum for Radar is measured in
**(A)** 1215-1400 MHz **(B)** 1800 MHz-2100MHz
**(C)** 1900 MHz-3000MHz **(D)** None of these

f. Pulse Doppler radar has ability to _____ unwanted echoes either by range gating or by doppler selection
**(A)** increase **(B)** decrease
**(C)** reject **(D)** All of these

g. Echoes from land or sea are called _____.
**(A)** volume clutter **(B)** rain clutter
**(C)** surface clutter **(D)** All of these

h. If the frequency response function of network maximize the peak signal to noise power ratio it is known as
**(A)** Doppler filter **(B)** Matched filter
**(C)** Passive filter **(D)** None of these

i. The relative target velocities resulting in zero MTI Response is called
**(A)** Blind speed **(B)** Average speed
**(C)** Neutral speed **(D)** None of these

j. The coho in MTI radar operates at
**(A)** IF **(B)** transmitted frequency
**(C)** received frequency **(D)** None of these

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

**Q.2** a. Draw the block diagram of a simple pulse radar and explain its operation. **(10)**

b. Discuss any six applications of RADAR. **(6)**

**Q.3** a. If a radar is designed for operation at 10 GHz with an antenna of diameter 2 m, calculate the peak pulse required to have a maximum range of 1000 km with a target of cross sectional area 20 $m^2$ with minimum detectable power of $36x10^{-5}$ W. **(8)**

b. How the different system losses are classified? Explain the effect of beam shape loss in radar. **(8)**

**Q.4** a. Explain the working of delay line canceller with suitable block diagram. **(10)**

b. The MTI radar is used by traffic control police to measure the speed of cars. If Doppler frequency shift measured from moving car is 1.6 KHz. Calculate the speed of car. Also indicate, how the approaching and receding car producing the same Doppler frequency shift may be distinguished? **(6)**

**Q.5** a. Derive the expression for Matched Filter characteristics. **(10)**

b. Explain the significance and working principle of Cross-Correlation Receiver. **(6)**

**Q.6** a. Explain the Mechanism of sea clutter. **(8)**

b. What is the effect of meteorological echoes on the simple radar equation? **(8)**

**Q.7** a. (i) What is the Difference between directive gain and Power gain? **(4)**
(ii) Define Effective aperture of Antenna. **(2)**
(iii) What is the Relation between directive gain and beam area? **(2)**
(iv) How does side lobe affects the radar performance? **(2)**

b. A paraboloid reflector operates at a frequency of 10GHz and it provides a power gain of $g_p$ =75dB. Find capture area of paraboloid and beam width. **(6)**

**Q.8** a. How does noise figure affects the receiver's performance? Explain the method used for Noise figure measurement in receiver. **(10)**

b. Find Noise figure in cascading network used in radar receiver. **(6)**

**Q.9** a. What type of the radiation pattern is needed for tacking radar? What is the significance of angular error and how it is achieved in sequential lobbing? **(10)**

b. How does conical scanning differ from sequential scanning? Explain in brief. **(6)**