Roll No. .....

Total Pages : 04

BT-8/D-14 **8811**

RADAR ENGINEERING

ECE-404-E

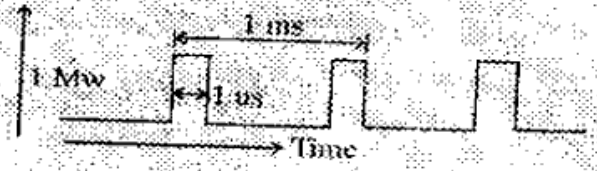
Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Section. All questions carry equal marks.

Section I

1. (a) List the Applications of Radar.

(b) A typical pulse waveform of radar is shown in figure below with its parameters. Calculate the (i) Average Power, (ii) Duty Cycle and (iii) Maximum range of radar ?



2. (a) What do you understand by Radar receiver noise and signal to noise ratio ? Explain in detail.

(b) What is the peak power of a radar whose average power is 200 W, pulse width is 1μs and has PRF of 1000 KHz ? Also calculate the range of this ground based radar if it has to detect a target with a radar cross section of 2 m^2 when it operates at a frequency of 2.9 GHz with a rectangular shaped antenna that is 5 m wide, 2.7 m height, antenna aperture efficiency of 0.6 and minimum detectable signal is 10^{-12} W ?

Section II

3. (a) Explain Doppler effect with necessary expressions and diagram in detail.

(b) A target is closing on a radial of a radar with a relative velocity of 200 knots. The radar transmits continuous wave energy at a wavelength of 5 cm. What will be the Doppler shift of the target ? What will be the Doppler shift in the target alters its course by 45° ?

4. (a) Explain the working of Multiple Frequencies CW Radar with necessary Block diagram.

(b) Compare the working of Simple CW and FM-CW radar with necessary diagrams and applications.

Section III

5. (a) List the different types of tracking radars with their brief introduction.

(b) Describe the various methods of mono pulse tracking technique.

6. (a) What do you understand by acquisition of target ? Explain any *one* method of antenna scanning.

(b) What do you mean by Tracking with Radar ? Explain block diagram of Tracking Radar.

Section V

7. (a) Explain the purpose of a Mixer and write the different types of Mixers used in Radars.

(b) Show that when a receiver noise figure F_{rec} is attached to an antenna with antenna noise temperature T_A, the system noise figure F_{sys} is given by $F_{sys} = (T_A/T_0) + F_{rec}$?

8. Write short notes on the following :

(a) Low noise front ends

(b) Receiver Protectors.