JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2024

B.Tech-VIII Semester (ECE)

COURSE CODE (CREDITS): 18B1WEC839 (3) MAX. MARKS: 15

COURSE NAME: Radar Principles and Applications

COURSE INSTRUCTORS: Dr. Vikas Baghel MAX. TIME: 1 Hour

***Note: (a)** All questions are compulsory.*

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems.

Q1. a) What is the basic principle behind radar technology? Explain the fundamental components and their functions in a radar block diagram. **[3]** **[CO1]**

b) Discuss in detail the concept of radar propagation effects and their significance in radar systems. **[2]**

Q2. a) Discuss the derivation of the Radar Equation and its significance in the design and operation of radar systems. **[2]** **[CO1]**

b) Show that a radar with the parameters listed below, will get a reasonable S / N on an small aircraft at 80 nmi. **[3]**

Range- 80 nmi

Aircraft cross section- 2 m^2

Peak Power- 1.5 $Megawatts$

Bandwidth- 1.6 MHz

Frequency- 3000 MHz

Antenna Rotation Rate- 15 RPM

Pulse Repetition Rate- 1200 Hz

Antenna Size- 4.9 m wide by 2.7 m high

Azimuth Beamwidth- 1.35 $degree$

System Noise Temp.- 950 $degree\ K$

Q3. a) Derive the expression for Doppler frequency shift in radar when the target is moving away from the radar system. **[2]** **[CO2]**

b) A Radar with a frequency of 10 GHz emits a signal towards a moving target with a velocity of 100 m/s. Calculate the Doppler frequency shift if the radar is facing the target directly. **[1]**

c) Explain the basic principles behind the operation of a CW Doppler radar system and how it utilizes the Doppler effect to detect moving objects. **[2]**