

1) A RADAR System transmits a signal of frequency 5GHz. The System detects a moving target with a radial velocity of 1000 m/s. Calculate the Doppler Frequency Shift.

$$f_{dp} = ?$$

$$V = 1000 \text{ m/s}$$

$$f_t = 5 \text{ GHz}$$

$$V = \frac{\lambda f_{dp}}{2} \Rightarrow f_{dp} = \frac{2V}{\lambda}$$

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{5 \times 10^9}$$

$$\lambda = 0.06 \text{ m}$$

$$f_{dp} = \frac{2 \times 1000}{0.06}$$

$$f_{dp} = \underline{33.33 \text{ KHz}}$$

2) A RADAR System transmits a signal with a frequency of 2.6 GHz. The doppler Shift Signal has been Calculated as 21 KHz. Calculate the Velocity of the target.

Soln $f_t = 2.6 \text{ GHz.}$

$$f_{dp} = 21 \text{ KHz.}$$

$$V = \frac{\lambda f_{dp}}{2}$$

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{2.6 \times 10^9}$$

$$\lambda = 0.115 \text{ m.}$$

$$V = \frac{0.115 \times 2 \times 10^3}{2.}$$

$$\underline{V = 1211.5 \text{ m/s}}$$

3) A continuous wave radar system operates with the speed of light. The radar measures a time delay of 5×10^{-6} seconds. Calculate the distance to the target.

Sol:

$$\Delta t = 5 \times 10^{-6}$$

$$R = ?$$

$$\Delta t = \frac{2R}{c} \Rightarrow R = \frac{c \cdot \Delta t}{2}$$

$$R = \frac{3 \times 10^8 \times 5 \times 10^{-6}}{2}$$

$$R = 750 \text{ m}$$

4) A Radar System detect an object at a distance of 1250m. Calculate

the time delay

Sol

$$R = 1250 \text{ m}$$

$$\Delta t = \frac{2R}{c} = \frac{2 \times 1250}{3 \times 10^8}$$

$$\Delta t = 8.3 \times 10^{-6} \text{ s}$$