Question Bank of Radar:

1. Compare the amplitude-comparison monopulse tracker and the conical scan tracker with respect to accuracy at long, medium, and short ranges; complexity; the number of pulses usually used for an angle measurement; and the type of application where each might be preferred.

2. (a) Why is the amplitude-comparison monopulse more likely to be preferred over the phase-comparison monopulse?
   (b) Why is the conical scan tracker more likely to be preferred over the sequential lobing, or lobe switching, tracker?

3. A target has an effective depth in the radial (range) dimension of 15 m. What must be the change in frequency in order to get a decorrelated measurement of angle glint?

4. What two measures might be taken to reduce the effects of the glint error in both angle and range?

5. (a) Why does a tracking radar have poor accuracy at low elevation angles?
   (b) Summarize the two methods that may be worth considering when it is necessary to avoid poor tracking of targets at low altitudes.

6. What might be the upper bound of the resonant frequency of the servo when the tracking antenna is 30 ft in diameter?

7. (a) What is meant by beam splitting?
   (b) Describe briefly how is it accomplished?
   (c) What accuracy might it typically have?

8. Under what conditions does the Kalman filter perform like α-β tracking filter?

9. (a) What is the chief advantage of automatic detection and tracking?
   (b) What are its limitations?

10. The input signal to the matched filter is $s(t) = (A/T)(T - t)$, where $0 \leq t \leq T$. Sketch the following:
    (a) The input signal,
    (b) The impulse response of the matched filter, and
    (c) The output signal from the matched filter.
    (d) Why is this particular waveform unrealizable?

11. (a) Draw the block diagram of a correlation receiver.
    (b) Explain why the correlation receiver can be considered equivalent to the matched filter receiver in detection performance.
    (c) Under what conditions, if any, might one chose to implement a correlation receiver rather than a matched filter receiver?

12. Sketch the matched-filter frequency response function when the waveform is just one RF cycle of sinewave in duration.

13. Show that the impulse response of a matched filter [$h(t) = G_a s(t_m - t)$] is the inverse Fourier transform of its frequency response function $H(f) = G_a S^*(f) \exp(-j2\pi f t_m)$.

14. Why is a CFAR needed in some radars? What are the disadvantages of using CFAR?

15. What does one have to do in a radar system to avoid the use of a conventional CFAR?

16. What are the advantages and limitations of a binary integrator?

17. How does the performance of a radar operator making detection decisions by viewing the raw (unprocessed) video output of a radar display compare to the performance of an automatic (electronic) detector?

18. What are the units of the constant G_a in the expression for the matched filter frequency response function given by $H(f) = G_a S^*(f) \exp(-j2\pi f t_m)$.

19. (a) Sketch the rms range error (in meters) for a quasi-rectangular pulse with a half-power pulse width of 2 μs, as a function of the peak-signal-to-mean-noise ratio ($2E/N_0$) over the range of values from 10 to 60 dB.
    (b) Why might it not be appropriate to consider signal-to-noise ratios below 10 dB and above 60 dB?

20. Derive the rms error in measuring the time delay for a Gaussian pulse of half-power width τ.

21. Derive the rms error in measuring frequency for a rectangular pulse of width τ.

22. How is the rms error in measuring frequency affected when the width of a rectangular pulse is increased by a factor of four, with the peak power remaining constant?

23. What is the message of the "radar uncertainty principle"?

Assignment 1:

1. Define RADAR. Explain the basic principle of RADAR.

2. Draw the block diagram of RADAR and explain each part.

3. Derive the simple form of RADAR range equation.

4. Calculate the maximum radar range in terms of signal to noise ratio.

5. Define the following:- propagation effect, Antenna loss, Plumbing loss, ducting effect.

6. What are the different types of system losses?

Assignment 2:

1. What do you understand by Doppler Effect?
2. Explain the construction and working of FMCW radar.
3. What is the difference between pulse radar and CW radar?
4. What do you understand by term MTI?
5. Differentiate between MTI and pulse Doppler radar.
6. Describe the various aspects of MTI from a moving platform.
7. What is the necessity of delay line canceller?