

Department of ECE

B. Tech. mid Question Bank (R20 Regulation)

Academic Year: 2024-25

Semester: VII

Subject Name: RADAR SYSTEMS

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PART-A

| Q.NO | QUESTIONS | MARKS | BL | CO | UNIT NO. |
|------|--|-------|-------|-----|----------|
| 1 | Define minimum detectable signal? | 2M | L2 | CO1 | I |
| 2 | Define the term radar range and write the equation? | 2M | L1 | CO1 | I |
| 3 | Radar angular measurements are referenced to true north and local horizontal plane. With reference to them Define Azimuth and Elevation angles and their ranges? | 2M | L2 | CO1 | I |
| 4 | Define PRF? | 2M | L1 | CO1 | I |
| 5 | A Radar System transmits pulses of duration $2 \mu\text{s}$ and a repetition rate of 1KHz. Find the maximum and minimum range of Radar. | 2M | L2,L1 | CO1 | I |
| 6 | Discuss SNR? | 2M | L1 | CO1 | II |
| 7 | Discuss applications of CW Radar | 2M | L2 | CO2 | II |
| 8 | Explain the range and Doppler measurement in FM CW Radar | 2M | L1 | CO2 | II |
| 9 | Describe the Doppler Effect for Radar | 2M | L2 | CO2 | II |
| 10 | Establish a relation between Doppler frequency shift and radial velocity of a moving target. | 2M | L1 | CO2 | II |
| 11 | Describe the different noise components present in radar | 2M | L2,L1 | CO2 | II |

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| | systems | | | | |
| 12 | Discuss about detection of signals in noise? | 2M | L1 | CO2 | II |
| 13 | Draw the block diagram of MTI Radar with power amplifier Transmitter? | 2M | L1 | CO3 | III |
| 14 | Define MTI radar? | 2M | L2,L4 | CO3 | III |
| 15 | List the applications of Pulse Doppler Radar? | 2M | L1 | CO3 | III |
| 16 | What are the limitations of MTI radar | 2M | L2,L4 | CO3 | III |
| 17 | Differentiate between MTI and Pulse Doppler Radar? | 2M | L3 | CO3 | III |
| 18 | Discuss MTI Radar Parameters | 2M | L1 | CO3 | III |
| 19 | Explain about sequential lobing? | 2M | L1 | CO4 | IV |
| 20 | Discuss the principle of operation of conical scan? | 2M | L2 | CO4 | IV |
| 21 | Define Squint Angle? | 2M | L3 | CO4 | IV |
| 22 | Explain the tracking radar and search radar system? | 2M | L4 | CO4 | IV |
| 23 | Draw the block diagram of Monopulse radar? | 2M | L5 | CO4 | IV |
| 24 | Discuss about the scanning patterns? | 2M | L1 | CO4 | IV |
| 25 | Explain Beam width Changes in receiver | 2M | L1 | CO5 | V |
| 26 | Discuss advantages and limitations of Radar receiver | 2M | L2 | CO5 | V |
| 27 | What are the different types of antennas used in Radar | 2M | L3 | CO5 | V |
| 28 | Draw the block diagram of cross correlation receiver | 2M | L4 | CO5 | V |
| 29 | Give the comparison between the efficiency of matched and non matched filters. | 2M | L5 | CO5 | V |
| 30 | Compare Various Trackers | 2M | L1 | CO5 | V |

PART-B

| Q.NO | QUESTIONS | MARKS | BL | CO | UNIT NO. |
|------|--|-------|-------|-----|----------|
| 1 | Discuss System losses in radar? | 3 | L2 | CO1 | I |
| 2 | Calculate the range of a target, if the time taken by the signal to travel and return is 100 micro seconds? | 3 | L1 | CO1 | I |
| 3 | Define minimum detectable signal? Calculate minimum receivable signal in a radar receiver that has an IF bandwidth of 1.5 MHz and a 9-dB noise figure | 3 | L2 | CO1 | I |
| 4 | Discuss in brief the radar range equation and modified radar range equation. | 3 | L1 | CO1 | I |
| 5 | What is Maximum Unambiguous Range? How is it related with pulse repetition rate? | 6 | L2,L1 | CO1 | I |
| 6 | Explain the Radar Cross Section (RCS) of sphere and cone-sphere targets? | 6 | L1 | CO1 | II |
| 7 | A low power, short range radar is solid-state throughout, including a low-noise RF amplifier which gives it an overall noise figure of 4.77dB. If the antenna diameter is 1m, the IF bandwidth is 500 kHz, the operating frequency is 8 GHz and the radar set is supposed to be capable of detecting targets of 5m ² cross sectional area at a maximum distance of 12 km, what must be the peak transmitted pulse power | 6 | | | |
| 8 | Explain why post detection integration is not as efficient as pre-detection integration of radar pulses? | 3 | L1 | CO1 | II |
| 9 | A pulsed Radar operating at 10Ghz has an Antenna with a gain of 28 dB& a transmitting power of 2 KW. If it is defined to detect a target | 3 | L1 | CO1 | II |

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| | with a cross-section of 12 m ² & the minimum detectable signal $S_{min} = -90$ dBm, what is the maximum range of Radar | | | | |
| 10 | Calculate the Doppler frequency of an aircraft moving with a speed of 550 Knots and when the CW radar is working with $\lambda=8$ cms | 3 | L2,L1 | CO2 | II |
| 11 | Discuss the following a) Non-Zero F receiver b) Isolation between the transmitter and receiver. | 3 | L1 | CO2 | II |
| 12 | Discuss about FM-CW Altimeter in detail? | 6 | L1 | CO2 | II |
| 13 | Explain the receiver bandwidth requirements of FM- CW Radar? | 6 | L2,L4 | CO2 | II |
| 14 | Draw the block diagram of a FM-CW Radar | 6 | L1 | CO2 | II |
| 15 | With a transmit (CW) frequency of 5GHz, calculate the Doppler frequency seen by a Stationary Radar when the target radial velocity is 100 km/h (62.5 mph) | 3 | L2,L4 | CO2 | II |
| 16 | Explain range and Doppler measurement in FM-CW Radar | 3 | L1 | CO2 | II |
| 17 | Derive the expression for the velocity of the target when the target is moving away from the radar in the case FM-CW radar | 3 | L1 | CO2 | II |
| 18 | Determine the beat frequency due to range and the quantization error if range=100m, and the frequency excursion is 75Hz and modulating frequency is 1Khz | 3 | L2 | CO2 | II |
| 19 | Explain MTI radar with a block diagram. | 6 | L1 | CO3 | III |
| 20 | Explain the function of time domain filter in a MTI Radar with an example | 6 | L1 | CO3 | III |
| 21 | Discuss the principle operation of Range Gated Doppler Filter | 6 | L2,L4 | CO3 | III |
| 22 | An MTI radar operates at 5GHz with a pulse repetition frequency of 900 Hz. Calculate the lowest three blind speeds of this radar. | 3 | L1 | CO3 | III |

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| 23 | What is the distinctive feature that makes the MTI radar and Pulse Doppler to differ? | 3 | L3 | CO3 | III |
| 24 | Calculate the blind speed for a Radar with the following specifications: Wave length: 0.1 mtr and PRF : 200 Hz | 3 | L5 | CO3 | III |
| 25 | In mono pulse radar two antennas are used to produce a phase difference of 250° between the echo signals. It operates at frequency of 1.5 GHz. Find the spacing between the antennas, if the angle $\theta=150^\circ$? | 3 | L2 | CO4 | IV |
| 26 | Illustrate neat diagram explain the operation of a conical scan Radar. Explain the various factors that need to be considered for optimum squint angle | 6 | L3 | CO4 | IV |
| 27 | Discuss with the help of a block diagram amplitude comparison monopulse radars for extracting error signals in both elevation and azimuth? | 6 | L2 | CO4 | IV |
| 28 | Illustrate the differences between conical and mono pulse Tracking Radars? | 6 | L1 | CO4 | IV |
| 29 | Draw and explain the following with respect to Tracking in range: i. Echo pulse ii. Early-late range gates iii. Difference signal between early and late range gates | 3 | L2 | CO4 | IV |
| 30 | Explain the block diagram of sequential lobing | 3 | L2 | CO4 | IV |
| 31 | Explain with the help of a neat block diagram Amplitude comparison Monopulse radar for extracting error signals in both Azimuth and Elevation | 3 | L3 | CO4 | IV |
| 32 | Discuss in brief about scanning patterns? | 3 | L2 | CO4 | IV |
| 33 | Illustrate the Limitations of automatic detection and tracking | 6 | L4 | CO4 | IV |
| 34 | Define correlation? Explain cross correlation with the help of neat | 6 | L5 | CO5 | V |

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| | block diagram. | | | | |
| 35 | A radar receiver is connected to a 30 ohm resistance antenna that has an equivalent noise resistance of 25 ohm. Calculate the noise figure of the receiver and the equivalent noise temperature of the receiver | 6 | L2 | CO5 | V |
| 36 | Discuss: i) beam steering ii) beamwidth of phased array antennas. | 3 | L2 | CO5 | V |
| 37 | List and explain the applications, advantages and limitations of phased array antennas. | 3 | L2 | CO5 | V |
| 38 | Draw and explain balanced type duplexer. | 3 | L4 | CO5 | V |
| 39 | Discuss short note on a) Noise figure and Noise temperature | 3 | L5 | CO5 | V |
| 40 | Discuss in brief about Matched filter with Non-White Noise | 6 | L4 | CO5 | V |
| 41 | Explain different types of displays | 6 | L2 | CO5 | V |
| 42 | Write short notes on radiation pattern of phased array antennas with suitable equations. | 6 | L3 | CO5 | V |