Code No: **R1641041** **R16** **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February - 2020

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) List out system losses. [2]
   b) List out the advantages, disadvantages, and applications of CW Radar. [3]
   c) Define blind speed. Represent each term in equation. [2]
   d) Justify the role of error signal in conical scan tracking radar. [3]
   e) Define noise figure and noise temperature. [2]
   f) Define series feed and draw the circuit. [2]

PART–B *(4x14 = 56 Marks)*

2. a) Derive the modified radar range equation. [7]
   b) Explain the pulse integration technique. [7]

3. a) Prove that $f_d \approx v_t / \lambda$. [7]
   b) Explain the need of isolation between transmitter and receiver. Suggest suitable components. [7]

4. a) Explain the working principle of a MTI Radar. [7]
   b) If a MTI Radar operates at 10GHz with PRF of 0.8KHz, then find the three lowest blind speeds. Assume necessary data. [7]

5. a) Explain the Mechanism of low-angle tracking Radar. [7]
   b) In a monopulse radar, two antennas are separated by $\lambda/2$ and angle θ between the line of sight and perpendicular bisector of the line joining the two antennas is 5°. Find the phase differences between the Echo signals in the Antennas. Assume necessary data. [7]

6. a) The noise figure of a radar receiver is 12dB and if bandwidth is 2MHz. Find its minimum receivable signal. Assume necessary data. [7]
   b) Prove that $R_f \leq 2E / N_0$ in matched filter receiver. [7]

7. Discuss in detail about
   (i) Radomes (ii) Displays [14]

Code No: **R1641041** **R16** **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, July/Aug - 2021

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) What is Radar Cross Section? What is its significance? [3]
   b) Define CW and FMCW radar? [2]
   c) Determine PRF of an MTI Radar operating at f=10GHz if it shows the lowest blind speed of 20m/s? [3]
   d) Define nutating feed in conical scan tracking? [2]
   e) Write the characteristics of matched filter. [2]
   f) Define parallel feed and draw the circuit? [2]

PART–B *(4x14 = 56 Marks)*

2. a) If a pulse radar operating with a peak power of 1MW has the following parameters: pulse width=1.2μs and PRI= 1ms. Find P_{avg} , duty cycle and R_{max}? [7]
   b) List out the system losses and explain any two losses? [7]

3. a) Explain the principle of FM-CW altimeter? [7]
   b) Derive the Doppler frequency in CW radar? List out the limitations in CW radar? [7]

4. a) List out the types of cancellers and explain any one of them. [7]
   b) Explain the function of Range gated Doppler filters. [7]

5. a) Explain the function of Sequential lobing Radar? [7]
   b) Compare mono pulse tracker and the conical Scan tracker w.r.to accuracy at long, medium and short ranges? [7]

6. a) Define noise temperature? Derive N-stage cascade network? [7]
   b) The signal energy of a linear filter 5T whose impulse response is matched to the signal. If the input noise power spectrum density is $N_0/2$, find the maximum instantaneous SNR? [7]

7. Write a notes on
   (i) Radiation pattern of phased array antennas [14]
   (ii) balanced type Duplexer

Code No: **R1641041** **R16** **Set No. 1**

IV B.Tech I Semester Regular/Supplementary Examinations, March - 2021

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) What are the main reasons for the failure of the simple form of the radar equation? [2]
   b) If the target and the Frequency source are moving close to each other, with constant velocity, explain the change in the frequency? [3]
   c) Define Doppler frequency in MTI radar? [3]
   d) What is Squint angle? [2]
   e) Write the equation for Noise figure. [2]
   f) What are different types of duplexers used in radar receivers? [2]

PART–B *(4x14 = 56 Marks)*

2. a) Explain how system losses effects the radar range. [7]
   b) Compute the maximum detectable range of a radar system specified below: Operating wavelength = 3.2 cm, Peak pulse transmitted power = 500 kW, Minimum detectable power = 0.1pW, Capture area of the antenna = $5m^2$ and a Radar cross sectional area of the target $5m^2$ .G=1000; [7]

3. a) With the help of a suitable block diagram, explain the operation of a CW radar with non- zero IF in the receiver. [7]
   b) Differentiate the operation of pulse Radar from simple CW Radar. [7]

4. a) Discuss about blind speeds. [7]
   b) Discuss about the internal Fluctuation of clutter which limits the performance of MTI radar. [7]

5. a) List the merits and demerits of Mono pulse tracker over conical scan type tracker. [7]
   b) Explain Split-range-gate tracking with diagrams. [7]

6. a) Describe the operation of matched filter with non white noise. [7]
   b) Discuss in detail about Matched-filter Receiver with necessary expressions. [7]

7. a) Describe briefly various visual displays to view radar echo signals in radar systems. [7]
   b) Describe the principle behind the operation of a phased array antenna in a radar system. [7]

Code No: **R1641041** **R16** **Set No. 2**

IV B.Tech I Semester Regular/Supplementary Examinations, March - 2021

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) What do you mean by maximum unambiguous range? [3]
   b) What are interferences that effect the velocity measurements in CW or FMCW radars? [3]
   c) Define MTI improvement factor. [2]
   d) Describe the single lobe scanning. [2]
   e) What is a matched filter Receiver? [2]
   f) What are the limitations of Redomes? [2]

PART–B *(4x14 = 56 Marks)*

2. a) Derive the Radar range equation and discuss about its applications. [7]
   b) Use the radar range equation to determine the required transmit power for a pulse radar given that S_{min} =10-13 Watts, G=2000 $\lambda = 0.23m$, PRF=524Hz σ=2.0m^2 for a target range of 70Km. [7]

3. a) Explain the principle of Doppler effect and its application of CW Radar. [7]
   b) With neat sketch explain the principle of operation of FM CW radar. [7]

4. a) Explain in detail about Internal fluctuation of clutter of an MTI Radar. [7]
   b) Explain very briefly the following limitations of MTI radar.
   (i) Equipment in stabilities.
   (ii) Scanning modulation.
   (iii) Internal fluctuation of clutter. [7]

5. a) Draw the block diagram of an amplitude comparison mono pulse tracking radar in azimuth and elevation directions. Explain the functioning. [7]
   b) Why does tracking radar have poor accuracy at low elevation angles? Explain. [7]

6. a) What is a matched filter receiver? Derive its frequency response function. [7]
   b) Explain the differences between matched filter and non-matched filter. [7]

7. a) Discuss about the grating lobes in the phased array antennas used in radar systems. [7]
   b) Describe the operation of branch and balanced type duplexers with necessary diagrams. [7]

Code No: **R1641041** **R16** **Set No. 3**

IV B.Tech I Semester Regular/Supplementary Examinations, March - 2021

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) What is missed detection? [2]
   b) What are the applications of CW radar? [2]
   c) Define Clutter visibility factor. [3]
   d) List out and describe the basic methods of scanning. [2]
   e) What are the properties of Matched filter? [3]
   f) Compare Series and parallel feeds. [2]

PART–B *(4x14 = 56 Marks)*

2. a) State Radar range equation and discuss the influence of radar cross section on the range realizable. [7]
   b) Describe the effect of pulse repetition frequency on the estimated unambiguous range of radar. [7]

3. a) Explain how range and Doppler measurements are performed using FM CW radar. [7]
   b) Find out the Doppler frequency shift caused by a space borne target approaching with a relative velocity of 100 m/s with respect to a CW Radar operating at a carrier frequency of 6.0 GHz. (Velocity of electromagnetic wave can be assumed as 3 x 108 m/s) [7]

4. a) What are Delay line cancellers? Explain their filter characteristics. [7]
   b) List out the advantages of Non coherent MTI radar. [7]

5. a) Write the differences between conical and mono pulse Tracking Radars. [7]
   b) Describe the phase comparison mono pulse tracking technique in a radar system with the help of necessary block diagram. [7]

6. a) Explain the differences between matched filter and non-matched filter. [7]
   b) Define noise figure and equivalent noise temperature of a radar receiver. [7]

7. a) Describe the operation of branch and balanced type duplexers with necessary diagrams. [7]
   b) Write the advantages and limitations of Redomes. [7]

Code No: **R1641041** **R16** **Set No. 4**

IV B.Tech I Semester Regular/Supplementary Examinations, March - 2021

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) Write the applications of radar. [2]
   b) Establish a relation between Doppler frequency shift and radial velocity of a moving target. [2]
   c) Define blind speeds. Why do blind speeds occur? [2]
   d) Define scan and its importance in a Radar system. [2]
   e) What is the difference between matched filter and non-matched filter? [3]
   f) What is Radiation pattern? [3]

PART–B *(4x14 = 56 Marks)*

2. a) Explain the Radar Cross Section (RCS) of sphere and cone-sphere targets. [7]
   b) Derive the simple radar range equation in terms of minimum detectable signal to noise ratio (S/N)min and explain why (S/N) min is a better measure of a radar detection than the minimum detectable signal (Smin). [7]

3. a) Explain the principle of operation of CW Doppler radar with non zero IF receiver. [7]
   b) Explain how isolation between transmitter and receiver of a radar system can be achieved if single antenna is used for transmission and reception. [7]

4. a) With the help of necessary block diagram explain the operation of an MTI radar system with a power oscillator in the transmitter. [7]
   b) What is the target glint? Compute the improvement in tracking accuracy that is possible when tracking radar uses pulse-to-pulse frequency agility. It is given that the agility bandwidth is 200MHz, target depth is 7m, glint bandwidth is 5000Hz and the pulse repetition frequency is 30KHz. [7]

5. a) Explain the operation of a two-coordinate Amplitude comparison mono pulse Tacking Radar. [7]
   b) Compare and contrast conical scan and sequential lobbing type tracking techniques. [7]

6. a) Discuss the relation between the matched filter characteristics and correlation detection. [7]
   b) Derive the impulse response of a matched filter that is commonly used in a radar receiver. [7]

7. a) Describe briefly various visual displays to view radar echo signals in radar systems. [7]
   b) What is relation between the radiation pattern and current feed pattern in phased array radar? [7]

Code No: **R1641041** **R16** **Set No. 1**

IV B.Tech I Semester Regular Examinations, October/November - 2019

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) Define the Probability of detection. [2]
   b) Write the applications of CW Radar. [2]
   c) What is the first blind speed of an I-band Radar operating at 1.25 GHZ, when the PRF has a maximum unambiguous range of 380 km? [3]
   d) What are the drawbacks in sequential-lobing tracking? [2]
   e) Define noise temperature and describe the relation between noise figure and noise temperature. [3]
   f) Write the various functions of a duplexer. [2]

PART–B *(4x14 = 56 Marks)*

2. a) With the help of a neat block diagram, explain the principle of operation of Radar. [7]
   b) A Pulse Radar transmits a peak power of 1 MW. It has a PRT equal to 1000 micro sec. and the transmitted pulse width is 1 micro sec. Calculate (i) Maximum unambiguous range (ii) Average Power (iii) Duty Cycle (iv) Energy transmitted. [7]

3. a) How the Doppler shift and Radar range can be measured with FM-CW Radar? Explain. [7]
   b) Explain the operation of the multiple frequency CW Radar. [7]

4. a) Explain the operation of an MTI Radar with power oscillator transmitter. [7]
   b) Explain the frequency response characteristics of a MTI Radar using Range gated Doppler filters. [7]

5. a) Draw the block diagram and explain the operation of a Conical scan tracking Radar. [7]
   b) What is automatic detection and tracking? Explain its limitations. [7]

6. a) Explain the principle and characteristics of a Matched filter. [7]
   b) Derive the expression for matched filter's frequency response function. [7]

7. a) Draw and explain the structures of balanced duplexer during transmission and reception modes. [7]
   b) Briefly explain the concept of beam steering of Phased array antennas. [7]

Code No: **R1641041** **R16** **Set No. 2**

IV B.Tech I Semester Regular Examinations, October/November - 2019

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) Describe the functions performed by the Radar. [3]
   b) Define the Doppler effect. [2]
   c) What are the limitations of MTI Radar? [2]
   d) Define the elevation angle with respect to Radar. [2]
   e) Define the efficiency of a Matched filter. [2]
   f) Write advantages of phased array antennas. [3]

PART–B *(4x14 = 56 Marks)*

2. a) What are the various Radar system losses? Explain in detail. [7]
   b) A monostatic radar uses the same circular aperture antenna for transmission and reception at 8 GHz; its diameter is 2.6 m, aperture efficiency of 60%; and radiation loss of 1.04; the transmit path loss is 1.4. The radar is to produce a minimum detectable signal of 4×10^{-14} w, when the targets radar cross section is 1 m^2 at a maximum range of 92 km. If the channel has a one way loss of 1.6, what transmitter peak power is required if the antenna points directly to the target? [7]

3. a) Explain the principle of operation of Frequency Modulated Continuous Wave Radar with a neat block diagram. [7]
   b) Calculate the Doppler frequency seen by a Stationary Continuous Wave Radar with a transmit frequency of 5 GHz when the target radial velocity is 100 km/h. [7]

4. a) What is the importance of staggered pulse repetition frequencies in the design of an MTI Radar? Explain. [7]
   b) Explain the function of a single delay line canceller and derive an expression for the frequency response function. [7]

5. a) Explain amplitude comparison Monopulse tracking radar with the help of a neat block diagram. [7]
   b) Write a brief note on acquisition and scanning patterns. [7]

6. a) Derive the expression for the frequency response of a Matched filter receiver with non white noise input. [7]
   b) Derive an expression for the effective Noise figure of two cascaded networks. [7]

7. a) Explain the functioning and characteristics of PPI display and A-Scope display. [7]
   b) What are Radomes? Explain its characteristics. [7]

Code No: R1641041 **R16** **Set No. 3**

IV B.Tech I Semester Regular Examinations, October/November - 2019

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) Write the applications of Radar. [2]
   b) What are the limitations of CW Radar? [2]
   c) Define Blind Speed and write the expression for it. [3]
   d) What are the functions of AGC in tracking Radar? [2]
   e) Define noise figure and describe the relation between noise figure and noise temperature. [3]
   f) Define beam width of an antenna and write the expression for it. [2]

PART–B *(4x14 = 56 Marks)*

2. a) What is probability of false alarm? Derive the expression for it. [7]
   b) In a Radar receiver the mean noise voltage is 80 mV and the IF bandwidth is 1 MHz. If the tolerable false alarm time is 25 minutes, calculate the threshold voltage level and the probability of false alarm. [7]

3. a) Explain the principle of operation of Continuous Wave Radar with non-zero IF receiver. [7]
   b) List down and explain the applications of CW and FM-CW Radar. [7]

4. a) Explain the operation of an MTI Radar with power amplifier transmitter. [7]
   b) A S-band air surveillance Radar operating at 3.1 GHz utilizes a staggered waveform with four different PRFs, which are 1222, 1031, 1138 and 1000 Hz.
      (i) What is the 1st blind speed if a constant PRF is used which has a PRT is equal to average of four periods of the staggered waveform?
      (ii) What is the first blind speed of the staggered PRF waveform? (Note that n_i for these four frequencies are 27, 32, 29 and 33 respectively). [7]

5. a) Explain the basic principle of a sequential lobing tracking Radar with neat diagrams. [7]
   b) What are the factors need to be considered for optimum squint angle? Explain. [7]

6. a) Derive the frequency response function of the matched filter. [7]
   b) Explain about the efficiency of non-matched filters. [7]

7. a) What is a Duplexer and explain the principle of operation of typical Duplexer with a schematic diagram. [7]
   b) How the beam width of a Phased array antenna varies with the steering angle? Explain. [7]

Code No: **R1641041** **R16** **Set No. 4**

IV B.Tech I Semester Regular Examinations, October/November - 2019

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

*****

PART–A *(14 Marks)*

1. a) Describe the classification of Radars. [2]
   b) List out the advantages of FM-CW Radar. [2]
   c) Compare the MTI and Pulse Doppler Radar. [3]
   d) Define the azimuth angle with respect to Radar. [2]
   e) Write the properties of Matched filter. [3]
   f) Write the limitations of phased array antennas. [2]

PART–B *(4x14 = 56 Marks)*

2. a) Derive the expression for Radar range equation in terms of Signal-to-noise ratio. [7]
   b) A Radar uses one antenna with a gain of $3x10^4$ and operates with a peak transmitter power of 50 kW, wavelength of 7.5 cm and a total loss of 1.6. For a target range of 97.2 nmi, what target radar cross section is needed to produce an available received power of $2x10^{-12}$ W, if antenna points directly to the target? [7]

3. a) Explain the principle of operation of FM-CW altimeter with a near diagram. [7]
   b) What are the factors that limit the amount of isolation between Transmitter and Receiver of CW Radar? Explain. [7]

4. a) What are the limitations of MTI Radar? Explain. [7]
   b) MTI radar is operating at a frequency of 9 GHz with a PRF of 3000 Hz. Calculate the first two lowest blind speeds for this radar. Derive the formula used. [7]

5. a) Explain the Monopulse tracking in two angel coordinates. [7]
   b) Compare the various tracking techniques. [7]

6. a) What is meant by correlation? Explain cross correlation with the help of a neat block diagram. [7]
   b) Define noise figure and noise temperature. Obtain the relation between them. [7]

7. a) Explain characteristics of different radar displays. [7]
   b) Draw and explain the radiation pattern of phased array antennas. [7]

R16

MODEL PAPER II

Jawaharlal Nehru Technological University Kakinada

B.Tech. IV Year I Semester Examination

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 Hours Max. Marks: 75

Solutions

Note: 1. Question paper consists of two parts (Part-A and Part-B)

2. Answering the question in Part-A is compulsory

3. Answer any Four Questions from Part-B

* * *

PART-A

1. (a) Explain the effect of weather on radar. (Unit-I / 04)

(b) Define Doppler frequency shift. (Unit-II / 02)

(c) What is the need of full wave rectifier in delay line canceller? (Unit-III / 03)

(d) Define a track-while-scan. (Unit-IV / 02)

(e) Define matched filter. (Unit-V / 01)

(f) List out the components which are used as duplexer. (Unit-VI / 02)

PART-B

2. (a) Discuss about the frequencies used for radar. (Unit-I / 02)

(b) A radar system transmits pulses of duration 2 ms and repetition rate of 1 kHz. Find the minimum and maximum range for radar. (Unit-I / 03)

3. (a) Explain Doppler shift and its role in pulsed and CW radar. (Unit-II / 01)

(b) With suitable diagrams, explain the constructions difference of CW radar and simple pulse doppler radar. (Unit-II / 02)

4. (a) With the help of neccessary block diagram explain the operation of an MTI radar system with a power amplifier in the transmitter. (Unit-III / 01)

(b) An MTI radar is operating at 10 GHz with a pulse repetition frequency of 1000 Hz. Calculate the lowest three blind speeds. (Unit-III / 02)

5. (a) With a block diagram sketch and explain conical scanning method of tracking an acquired target. (Unit-IV / 01)

(b) In mono pulse radar two antennas are used to produce a phase difference of 30° between the echo signals. It operates at frequency of 1.75 GHz. Find the spacing between the antennas if the angle $\theta = 18°$. (Unit-IV / 02)

6. (a) What do you understand by correlation. (Unit-V / 01)

(b) Obtain derivations of matched-filter characteristics of a receiver. (Unit-V / 03)

7. (a) What is display? Discuss various types of displays. (Unit-VI / 01)

(b) What is the overall noise figure of a transmission line and duplexer, which have a loss of 1.2 dB, connected to a receiver whose noise figure is 2.3 dB. (Unit-VI / 02)

R16

MODEL PAPER 2

Jawaharlal Nehru Technological University Kakinada

B.Tech. IV Year I Semester Examination

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 Hours

Max. Marks: 70

Note: 1. *Question paper consists of two parts (Part-A and Part-B)*
2. *Answering the question in Part-A is compulsory*
3. *Answer any Four Questions from Part-B*

Solutions

PART-A

1. (a) Define a creeping wave. (Unit-I / Q18)
   (b) List out the types of measurement errors. (Unit-II / Q14)
   (c) Define a STALO. (Unit-III / Q8)
   (d) What is automatic detection and track? (Unit-IV / Q5)
   (e) Define signal-to-noise ratio and noise figure of a radar receiver. (Unit-V / Q7)
   (f) Define the terms beamwidth and beam steering. (Unit-VI / Q9)

PART-B

2. (a) Derive the simple radar range equation in terms of minimum detectable signal to noise ratio (S/N)min and explain why (S/N)min, is a better measure of a radar detection than the minimum detectable signal (Smin). (Unit-I / Q35)
   (b) With the help of expressions explain radar transmitter power. (Unit-I / Q51)
3. (a) For an unambiguous range of 81 nautical miles (1 nautical mile = 1852 m) in a two frequency CW radar. Determine f_2 and Δf when f_1 = 4.2 kHz. Derive the expression to solve this problem. (Unit-II / Q32)
   (b) Mention salient features of FMCW radar. (Unit-II / Q38)
4. (a) Explain the concept of staggered PRFs in MTI radar. (Unit-III / Q28)
   (b) What is the highest frequency on which radar can be operated, if it is required to have a maximum unambiguous range of 200 nmi and no blind speeds less than 600 knots.
5. (a) Describe the operation of amplitude comparison mono pulse radar for single angular coordinate. (Unit-III / Q34)
   (b) Bring out the comparison of different tracking radars.. (Unit-IV / Q23)
8. (a) Define and distinguish between the terms: noise figure, noise temperature and system noise temperature of receivers. (Unit-IV / Q33)
   (b) Three network units each of 6 dB noise figure and 10 dB, 6 dB and 3 dB gains respectively are cascaded. Determine the overall noise figure of the system. (Unit-V / Q15)
7. (a) Define a duplexer and explain the working of different types of duplexers with neat diagrams. (Unit-V / Q20)
   (b) Describe the advantages, applications and limitations of phased array antennas in a radar system. (Unit-VI / Q18)

R16

MODEL PAPER 3

Jawaharlal Nehru Technological University Kakinada

B.Tech. IV Year I Semester Examination

RADAR SYSTEMS

(Electronics and Communication Engineering)

Time: 3 Hours | Max. Marks: 70

Note: 1. *Question paper consists of two parts (Part-A and Part-B)*
2. *Answering the question in Part-A is compulsory*
3. *Answer any Four Questions from Part-B*

Solutions

PART-A

1. (a) List out the types of plumbing losses. (Unit-I / Q20)
   (b) What are the limitations of power leakage in a radar transmitter? (Unit-II / Q8)
   (c) State the methods to reduce blind speeds in MTI radar. (Unit-III / Q6)
   (d) List out the scanning patterns to scan an area. (Unit-IV / Q11)
   (e) List out the characteristics of a matched filter. (Unit-V / Q3)
   (f) Write the merits of Phased array antennas. (Unit-VI / Q11)

PART-B

2. (a) Explain the concept of "PRF and Range Ambiguities". (Unit-I / Q53)
   (b) What signal-to-noise ratio is required for radar that makes a detection of the basis of a single pulse, when the probability of detection is 0.5 and the probability of false alarm is 10^{-6}? (Unit-I / Q57)
3. (a) Draw the block diagram of FM-CW radar using sideband superheterodyne receiver and explain its operation. (Unit-II / Q44)
   (b) What are advantages and disadvantages of FM-CW radar over multiple frequency CW radar? Explain. (Unit-II / Q51)
4. (a) Draw the block diagram of non-coherent MTI radar and explain the function of each block in detail. (Unit-III / Q39)
   (b) Differentiate between MTI and pulse doppler radar. (Unit-III / Q40)
5. (a) Draw and explain the block diagram of two-coordinate amplitude-comparison mono pulse tracking radar. (Unit-IV / Q24)
   (b) Differentiate between amplitude comparison and phase comparison methods of monopulse tracking. (Unit-IV / Q26)
6. (a) Explain the effect of noise in radar receiver's performance. Describe noise figure and noise temperature parameters. (Unit-V / Q17)
   (b) Find the overall noise figure of a radar receiver consisting of a low-noise RF amplifier with noise figure of 1.4 dB and gain of 15 dB, a mixer with 6 dB conversion loss and noise temperature ratio of 1.2 and an IF amplifier with noise figure of 1.0 dB. (Unit-V / Q18)
7. (a) With neat diagrams differentiate series feeds from parallel feeds. (Unit-VI / Q29)
   (b) Write a short note on, Radomes. (Unit-VI / Q33)