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

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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

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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 λ = 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

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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

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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]