INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

B.Tech VI Semester End Examinations (Regular) - May, 2019

Regulation: IARE – R16

RADAR SYSTEMS

Time: 3 Hours   **(ECE)**   **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Draw the radar block diagram and explain operation of each block. **[7M]**

   (b) Find the maximum range of a radar for a transmitted power of 250kW, cross-sectional area of the target of $12.5m^2$, minimum power received power of 10^{-3}W , antenna gain of 2000 and operating wavelength of 16cm. **[7M]**

2. (a) List out various system losses occurring in radar? Briefly describe about each loss. **[7M]**

   (b) Find the unambiguous range for a radar working with a pulse repetition frequency fP of 1000 K Hz. **[7M]**

UNIT – II

3. (a) Draw the block diagram and explain in detail about FM-CW radar system and explain. **[7M]**

   (b) For an ambiguous range of 81 nautical miles (1nmi=1852 meters) in a two frequency CW radar. Determine f_2 and Δf when f_1=4.2 kHz. **[7M]**

4. (a) Sketch the block diagram of FM-CW altimeter system and explain. **[7M]**

   (b) Explain the doppler shift phenomenon in a CW radar i spectral domain. Calculate the Doppler frequency of stationary CW radar transmitting at 6 MHz frequency when a moving target approaches the radar with a radial velocity of 100 Km/Hour. **[7M]**

UNIT – III

5. (a) Explain with the help of block diagram the operation of Noncoherent MTI radar. **[7M]**

   (b) Organize short note on Blind speeds in a MTI radar. In a MTI radar the pulse repetition frequency is 200 Hz and the carrier transmission frequency is 100 MHz. Find its first, second and third blind speeds. **[7M]**

6. (a) What are delay-line cancellers. Write about the filter characteristics of delay- line cancellers. **[7M]**

   (b) What is the highest frequency that a radar can be operated if it is required to have a maximum unambiguous range of 350 km and no blind speeds less than 100 m/s. **[7M]**

UNIT – IV

7. (a) Draw the block diagram of conical scan tracking radar and explain its operation. **[7M]**

   (b) For ground-based search radar with a beam width of 1.5 deg, the pulse repetition frequency is 300 Hz, and the antenna scan rate is 5 rpm (30deg /sec). Find the number of pulses returned from a point target as the radar scans through the beam width. **[7M]**

8. (a) What is matched filter? Obtain the impulse response of a matched filter in a radar system. **[7M]**

   (b) If the one way antenna power pattern of a conical scan tracking antenna is described by the Gaussian function, what is the loss in received signal when the target is directly at the beam cross over? The antenna half power beam width is 2^0 and the squint angle is 0.75^0? **[7M]**

UNIT – V

9. (a) How to find the number of pulses that returned from a point target as the radar antenna scans through its beam width? **[7M]**

   (b) Explain how will you design an application for Automatic Chocolate Vending Machine in detail. (Write with design and code.) **[7M]**

10. (a) Compare the series feeds and parallel feeds in phased array antennas. Explain the working of branch type duplexer with a neat diagram. **[7M]**

    (b) Analyze and design application for Adaptive Cruise Control System in car in detail. **[7M]**

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