



CBCS SCHEME

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Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024 Radar Engineering

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain a conventional pulse radar with super heterodyne receiver with a neat diagram. (10 Marks)
- b. A 10GHz radar has the following characteristics,
Peak transmitted power $P_t = 250KW$
Power gain of the antenna $G = 2500$
Minimum detectable peak power by receiver $S_{min} = 10^{-14}w$
Radar cross section of target, $\sigma = 2m^2$
Radar cross sectional area $A_e = 10m^2$
Find the maximum range. (06 Marks)
- c. List the applications of radar. (04 Marks)

OR

- 2 a. Define the following terms used in radar :
i) Maximum unambiguous range
ii) Average power
iii) Peak power
iv) Duty cycle
v) PRF. (10 Marks)
- b. Compute the following related to radar :
i) What should be the PRF of a radar to achieve maximum unambiguous range of 60nmi
ii) How long does it take for the radar signal to travel out and back when the target is at the maximum unambiguous range
iii) If radar has a peak power of 800kw, what is the average power? Choose pulse width of $1\mu s$. (06 Marks)
- c. Explain with neat diagram, basic principle of radar. (04 Marks)

Module-2

- 3 a. Discuss with equation, the probability of false alarm and probability of detection using an envelope detector. Draw the block diagram. (10 Marks)
- b. With a note on PRF and range ambiguity with necessary waveforms. (10 Marks)

OR

- 4 a. Briefly explain the plumbing loss and antenna losses in radar. (10 Marks)
- b. Explain briefly, the following radar cross section of the targets :
i) Sphere ii) Cone sphere. (10 Marks)

Module-3

- 5 a. With neat block diagram, explain how the Doppler frequency is extracted from CW and pulse Doppler radar. (10 Marks)
- b. With a block diagram, explain working MTI radar. (10 Marks)

OR

- 6 a. Define blind speed, UHF radar at 220MHz has a maximum unambiguous range of 180nmi
 i) What is the first blind speed (06 Marks)
 ii) Repeat, but for an L-band radar at 1250 MHz (08 Marks)
 iii) Repeat, but for an X-band radar at 9375MHz. (06 Marks)
- b. Explain the working of moving target detector with neat diagram. (08 Marks)
- c. Derive the equation for the frequency response of single delay line canceller. (06 Marks)

Module-4

- 7 a. Discuss various types of tracking radar systems. (06 Marks)
 b. Define monopulse tracker. Using block diagram, explain amplitude comparison monopulse tracking radar in one angle coordinate. (08 Marks)
 c. Discuss the concept of phase comparison monopulse. (06 Marks)

OR

- 8 a. Compare monopulse and conical scan radar. (06 Marks)
 b. Explain with a neat block diagram, conical scanning radar. (08 Marks)
 c. Discuss on tracking in range in tracking radar. (06 Marks)

Module-5

- 9 a. Explain the working of balanced duplexer with neat diagram. (10 Marks)
 b. Write short notes on different types of radar displays. (10 Marks)

OR

- 10 a. Write short notes on reflector antenna. (08 Marks)
 b. What are the functions of radar antenna? (06 Marks)
 c. Explain the following antenna parameters :
 i) Directive gain
 ii) Power gain
 iii) Effective aperture. (06 Marks)
