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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; May / June - 2019

Radar and Navigational Systems

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Explain the operation of conventional pulse radar with super heterodyne receiver with a neat block diagram. 9

b. Briefly discuss the applications of radar. 5

c. A ground-based air-surveillance radar operates at a frequency of 1300 MHz. Its maximum range is 200 nmi. for the detection of a target with a radar cross section of one square meter. Its antenna is 12 m wide by 4 m high, and the antenna aperture efficiency is 0.65. The receiver minimum detectable signal is 10^{-13} W. Compute the following : 6

i) Antenna effective aperture and Antenna gain

ii) Peak transmitter power

iii) Pulse repetition frequency to achieve a maximum unambiguous range of 200 nmi

iv) Average transmitter power, if the pulse width is 2 μs

2 a. Derive an expression for minimum detectable signal-to-noise-ratio. 8

b. Briefly discuss the concept of false alarm in radar detection. 6

c. A 1 kW, 3 GHz radar uses single antenna with a gain of 30 dB. The receiver has noise bandwidth of 1 kHz and noise factor of 5 dB. A target echoing area of 10 m^2 at a range of 10 nmi is to be detected. Compute the minimum signal-to-noise-ratio. 6

UNIT - II

3 a. Explain the basic principle of MTI radar that uses power amplifier as the transmitter with a neat block diagram. 8

b. Describe how the effect of blind phase is eliminated using Quadrature channel in digital MTI signal processor. 7

c. Show that a triple delay-line canceler is equivalent to a four pulse delay-line canceler with weights equal to coefficients of the binomial expansion with alternating signs. 5

4 a. Explain the basic principle of one angle coordinate monopulse radar with a neat block diagram. 8

b. Compare sequential lobing conical scanning radar tracking techniques. 6

c. Discuss briefly any three methods for reducing angle errors due to target glint. 6

Contd…2

UNIT - III

5	a.	Derive an expression for frequency response function of a matched filter which maximizes the peak-signal-to- noise- ratio.	8
	b.	Describe how sequential detection criteria is used for target detection in radar system?	6
	c.	Discuss the optimum envelop detector law used for extracting modulation from the carrier.	6
6	a.	Derive an expression for surface clutter echo signal power at low grazing angle.	8
	b.	Discuss the significance of Bragg scatter sea clutter model in the design of radar system.	6
	c.	Describe how Sensitivity Time Control (STC) method is used to avoid receiver saturation by clutter echoes?	6

UNIT - IV

7	a.	Explain with a neat sketch, the principle of operation of three-cavity klystron amplifier.	8
	b.	Discuss the advantages of using solid-state transistor amplifier as radar transmitters.	7
	c.	Compare forward and backward cross-field amplifiers (CFA'S).	5
8	a.	Describe the working of balanced and image-rejection mixers used in super heterodyne radar receiver with a neat block diagram.	10
	b.	Explain the following radar displays : i) Cathode ray tube display ii) Flat panel display	10

UNIT - V

9	a.	Discuss the following : i) Ambiguity of courses and its remove in LORAN-A, navigational system ii) Delay measurement in LORAN-A system	10
	b.	Explain the following Decca receiver structures : i) Fine fixing configuration ii) Lane identification configuration	10
10	a.	Explain the different GPS segments and the format of GPS navigation message.	10
	b.	Describe different modern navigational system along with their applications.	10

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