Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination December 2022 (2019 scheme)

Course Code: ECT401

Course Name: MICROWAVES AND ANTENNAS

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all questions, each carries 3 marks. Marks

1		Differentiate between Gain and Directivity of an antenna.	(3)
2		Derive expression for effective aperture of an antenna.	(3)
3		Explain the principle of operation of a Horn Antenna.	(3)
4		Explain the working of an Inverted – F antenna.	(3)
5		Explain the principle of Pattern Multiplication.	(3)
6		Explain the concept of phased arrays.	(3)
7		Derive expressions for the resonant frequency of a rectangular cavity resonator.	(3)
8		Derive expressions for the efficiency of a Reflex Klystron	(3)
9		List the important properties of Scattering parameters.	(3)
10		What do you mean by Gunn Effect?	(3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11	a)	With the help of a neat figure explain about the antenna field zones.	(6)
	b)	Derive expressions for the Radiation Resistance and Directivity of a short dipole antenna.	(8)

OR

12	a)	State and prove Reciprocity Theorem.	(7)
	b)	Derive Helmholtz Equation in terms of Vector Magnetic Potential.	(7)

Module II

13	a)	Explain the axial mode and normal mode of operation of a helical antenna.	(6)
	b)	Design a rectangular patch antenna using a substrate with a dielectric constant of 10.5, h = 0.126 cm so as to resonate at 1.65 Ghz .	(8)

OR

14	a)	Explain the steps involved in the design of a Log Periodic Dipole Array.	(7)

b) With the help of neat sketches explain the working principle of parabolic dish antenna. What are the typical feed antennas used with Dish antennas ? (7)

Module III

15 a) Derive expression for the total field radiated by two isotropic point sources fed with current of same amplitude and phase. Also find the directions of maxima and minima. (7)

b) Derive expressions for the array factor of a linear array of n-isotropic point sources of equal amplitude and spacing. Derive the conditions for using this array as an end fire array. (7)

OR

16 a) Explain the difference between broadside array and end fire array (4)

b) Design a 7 element Dolph-Chebyshev array with a spacing of d = $\lambda/2$. The pattern is to be optimum with a side lobe of 22 db down the main lobe maximum. (10)

Module IV

17 a) With the help of a neat diagram explain the working of a Reflex Klystron. (7)

b) A cylindrical magnetron has the following operating parameters : V_o = 25KV, I_o = 28A, B_o = 0.332 Wb/m^2 , a = 5 cm , b = 10 cm. Find (7)

a) Cutoff voltage for a fixed B_o,

b) Cut of magnetic Flux Density for a fixed V_o

OR

18 a) Derive expressions for the Hull cut off Magnetic Field and Voltage of a magnetron. (7)

b) With diagram explain the amplification process in a travelling wave tube (7)

Module V

19 a) Explain the important properties of Magic Tee. Derive its Scattering parameters (7)

b) Explain the different modes of operation of Gunn Diode. (7)

OR

20 a) Explain the working of two hole directional coupler. Derive its Scattering parameters. (7)

b) With the help of neat sketches explain the working of a circulator. (7)

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