

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 : $V_o = 25\text{KV}$, $I_o = 28\text{A}$, $B_o = 0.332 \text{ Wb/m}^2$, $a = 5 \text{ cm}$, $b = 10 \text{ cm}$. Find
- 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)
