

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S7 (R,S) (FT/WP/PT) Examination November 2025 (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

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|----|---|-----|
| 1 | Define radiation resistance of an antenna. Write the expressions for the radiation resistance of short dipole and half wave dipole. | (3) |
| 2 | Represent major lobe, minor lobe, HPBW, FNBW in a neat figure. | (3) |
| 3 | Describe any one feeding method for Parabolic dish antenna. | (3) |
| 4 | Write the design equations of a Horn antenna | (3) |
| 5 | Differentiate between broad side and end fire arrays. | (3) |
| 6 | What is the concept of phased arrays. | (3) |
| 7 | What are the features of a Cavity Resonator? Mention its main application. | (3) |
| 8 | What are slow wave structures? Illustrate the different types. | (3) |
| 9 | List the important properties of S matrix. | (3) |
| 10 | With neat diagram, explain the features of an H-plane Tee. | (3) |

PART B*Answer any one full question from each module, each carries 14 marks.***Module I**

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|----|---|-----|
| 11 | a) State and prove Helmholtz theorem. | (7) |
| | b) Calculate the approximate directivity of a unidirectional antenna if the normalized power pattern is given by: (a) $P_n = \cos \theta$ (b) $P_n = \cos^2 \theta$. Calculate the respective gains for an efficiency of $k=0.4$. | (7) |

OR

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|----|--|-----|
| 12 | a) Derive the value for Directivity of a short dipole. | (7) |
| | b) Calculate the radiation resistance of a dipole of length $\lambda/10$. What is the radiation resistance if the length is increased by 5 times? | (7) |

Module II

- 13 a) Describe the principle of Helical antenna. List out the features of the different modes. (8)
- b) List the design equations of a rectangular Microstrip patch antenna. (6)

OR

- 14 a) With all necessary design equations and schematic, describe the principle of Log periodic antenna (9)
- b) Calculate the required aperture area for an optimum rectangular horn antenna operating at 2 GHz with 12 dBi gain. (5)

Module III

- 15 a) Derive the expressions for the total field radiated by two isotropic point sources fed with currents of same amplitude and phase. Find the directions of pattern maxima and minima. (9)
- b) Write the design steps of a 2M element Dolph-Chebyshev array with spacing d between elements (5)

OR

- 16 a) Illustrate the principle of pattern multiplication with an example. (6)
- b) Derive the expression for the total field radiated by linear array of N isotropic point sources and write the expression for Array factor. (8)

Module IV

- 17 a) Explain the constructional details and principle of operation of Travelling Wave Tube with neat diagram. (8)
- b) Derive the expression for bunching parameter of a Reflex Klystron. (6)

OR

- 18 a) Explain the working of an 8 cavity Cylindrical Magnetron with neat diagram. (8)
- b) Derive the equation for the resonant frequency of a rectangular cavity resonator. Calculate the lowest resonant frequency of a rectangular cavity resonator of dimension $a = 2\text{cm}$, $b = 1\text{ cm}$, $d = 3\text{ cm}$. (6)

Module V

- 19 a) With a schematic, describe the principle of operation of Isolator. (7)
- b) Enumerate the constructional features of a two-hole directional coupler and derive the S matrix. (7)

OR

- 20 a) With neat figure, describe the principle of E-plane Tee. Obtain the S matrix of E-plane Tee. (7)
- b) With the help of a graph, list out the features of the four basic modes of operation of a Gunn diode. (7)
