

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EC306

Course Name: ANTENNA AND WAVE PROPAGATION (EC)

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

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|---|---|-------|
| 1 | a) State and Prove Reciprocity Theorem as applied to Antennas. | (8) |
| | b) Explain the concept of retarded potentials. | (4) |
| | c) Define Antennae Temperature. | (3) |
| 2 | a) Derive expressions for the Far Field components and Radiation Resistance of a half wave dipole. | (12) |
| | b) Define Gain and Directivity of an antenna. | (3) |
| 3 | a) Derive expressions for beam solid angle in terms of Directivity of an Antenna. | (4) |
| | b) Distinguish between Effective Aperture and Physical Aperture of an antenna. | (4) |
| | c) Draw an experimental setup and explain how radiation pattern measurement of an antenna is carried out. | (7) |

PART B

Answer any two full questions, each carries 15 marks.

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|---|---|------|
| 4 | a) State the Principle of Pattern multiplication. Explain and illustrate the principle with an N element array. | (7) |
| | b) With a neat diagram explain the principle of operation of a Horn antenna | (4) |
| | c) Explain the importance of Cassegrain Antennae. | (4) |
| 5 | a) Derive expressions for array factor of an N element linear uniform array and obtain its maximum value. | (6) |
| | b) Explain the construction and working of Rhombic Antenna | (6) |
| | c) Explain the basic Principle of Beam Steering. | (3) |
| 6 | a) Design a broadside Dolph –Tschebyscheff array of 8 elements with spacing of $d = \lambda/2$ between the elements and major to minor lobe ratio of 25 dB. | (10) |
| | b) Derive expressions and plot the pattern for the field radiated by two isotropic point sources fed with current of same magnitude and phase. | (5) |

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Explain the axial mode and normal mode of operation of a helical antenna. (6)
- b) A television transmitting antenna mounted at a height of 120m radiates 15kW of power equally in all directions in azimuth at a frequency of 50MHz .Calculate (i) maximum line of sight range (ii) the field strength at a receiving antenna mounted at a height of 16 m at a distance of 12 km and (iii) distance at which the field strength reduces to 1mV/m. (8)
- c) Explain Tropospheric scatter propagation. (6)
- 8 a) Design a rectangular microstrip antenna using a substrate with a dielectric constant of 2.25 and operating at 9 GHz. Take Height of Substrate ($h = 0.16$ cm). (10)
- b) Derive an expression for the LOS distance in km when the antenna heights above ground are h_t and h_r respectively for the transmitter and receiver Antenna. (5)
- c) Differentiate between critical frequency and maximum usable frequency. (5)
- 9 a) With the help of neat diagrams explain the principle of operation of Log Periodic Antenna. (8)
- b) What are the requirements for an antenna used in a mobile handset? Give some typical antennas used in cellular handsets. (6)
- c) Explain the diversity techniques employed in wave reception. (6)
