

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.*

- |   |   | Marks |
|---|---|-------|
| 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)

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