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Roll No. of candidate

2019

B.Tech. 8th Semester End-Term Examination

ANTENNA AND WAVE PROPAGATION – ELECTIVE V (OPEN)

Full Marks – 100 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *six* from the rest.

1. Answer the following questions : (10 × 1 = 10)

(i) The unit of magnetic scalar potential is ———.
- (a) Volts
- (b) Ampere
- (c) Weber
- (d) Henry

(ii) The unit of poynting vector is
- (a) Watts
- (b) watts/m
- (c) watts/m^2
- (d) watts/m^3

(iii) A field can exist if it satisfies
- (a) Gauss's law
- (b) Faraday's law
- (c) Coulomb's law
- (d) all Maxwell's equations

[Turn over

(iv) For a 300 Ω antenna operating with 5A of current, the radiated power is

(a) 7500 W

(b) 750 W

(c) 75 W

(d) 1500 W

(v) The current distribution in a half-wave dipole is _____.

(a) Constant

(b) Sinusoidal

(c) Triangular

(d) Ramp

(vi) Basic transmission loss between two antennas depends on _____.

(a) Frequency

(b) Distance

(c) Frequency and distance

(d) Gain of antennas

(vii) In an end-fire array, there exists no radiation at _____ to the axis of the array.

(viii) The side lobes of the patterns of Dolph-Tchebysheff amplitude distribution are –

(a) At equal levels

(b) At different levels

(ix) Rhombic antenna is

(a) Travelling wave antenna

(b) Standing wave antenna

(c) Narrow-band antenna

(d) Used in LF bands

(x) Critical frequency of the ionospheric layer is —

(a) $f_c = 81\sqrt{N_{max}}$

(b) $f_c = 81\ N_{max}$

(c) $f_c = 9\sqrt{N_{max}}$

(d) $f_c = 9\ N_{max}$

2. (a) State and prove equation of continuity for time-varying fields. [5]

(b) State and explain each Maxwell's equations. [4]

(c) Establish the relation between **E** and **H**. [6]

3. (a) Define Antenna. How compensation theorem is applied in it? [4]

(b) Define the antenna parameters: [6]

(i) Effective Length of Antenna

(ii) Radiation Resistance

(iii) Antenna Efficiency

(c) Find the radiation efficiency of a Hertzian dipole of length 0.03λ at a frequency of 100MHz if the loss resistance is 0.01Ω. [5]

4. (a) Briefly explain the Friis Transmission formula. [5]

(b) If a electric field at a far zone point 5km distance from an aerial is 10m V/m. What is the value at a point 10km away in the same direction? [4]

(c) Differentiate and explain Broadside and End-fire arrays with neat diagrams. [6]

5. (a) Derive the radiation pattern for an array of two isotropic point sources with equal amplitude and opposite phase. [7]

(b) Briefly explain the pattern of multiplication. And derive the radiation pattern of 8 – isotropic elements fed in – phase, spaced $\lambda/2$ apart. [8]

6. (a) Design a Rhombic antenna to operate at a frequency of 30 MHz with the angle of elevations, Δ = (i)25°, (ii) 30° [6]

(b) Design a Yagi-Uda antenna of 5 elements to provide a gain of 10 dBi if the operating frequency is 219.5 MHz. [5]

(c) Briefly describe the construction and operation of a Helical antenna. [4]

7. (a) List the factors involved in the propagation of radio waves. [5]

(b) Briefly explain any five characteristic parameters of ionospheric propagation. [5]

(c) What is fading? List its types. Briefly explain any three of its types. [5]

8. (a) Classify antennas into different categories. [5]

(b) Give the advantages and disadvantages of microstrip patch antennas. [5]

(c) A parabolic antenna having a circular mouth is to have a power gain of 1500 at λ = 15 cm. Estimate the diameter of the mouth and the half power beam-width of the antenna. [5]

9. Briefly explain the following: $(5 \times 3 = 15)$

(a) Capture Area

(b) Non-Resonant Antenna

(c) Ground wave propagation

(d) Hansen-Woodyard End-fire Array

(e) Relation between Directivity and Effective Aperture.
