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EC 1318 E 054

Roll No. of candidate | | | | | | | | | | |

2020

B.Tech. 8th Semester End-Term Examination

ANTENNA AND WAVE PROPAGATION

Full Marks – 50 Time – Two hours

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

Answer Question No. 1 (any *five*) and any 3 (*three*) from the rest.

1. Answer all questions : $(5 \times 1 = 5)$

   (i) Poynting vector gives
   - (a) Rate of energy flow
   - (b) Direction of polarization
   - (c) Electric Field
   - (d) Magnetic Field

   (ii) Marwell's equations give the relations between
   - (a) Different fields
   - (b) Different sources
   - (c) Different boundary conditions
   - (d) None of these

[Turn over

(iii) If loss resistance increases, the radiation efficiency

(a) Increases

(b) Does not change

(c) Decreases

(d) Unpredictable

(iv) Brewster angle is

(a) Angle of incidence for which there is no reflection

(b) Angle of reflection for which there is no reflection

(c) Equal to reflected angle

(d) Equal to refraction angle

(v) Circularly polarized antenna is

(a) Dipole

(b) Parabolic Dish

(c) Yagi-Uda

(d) Helical

(vi) X-band frequency is

(a) 1-2 GHz

(b) 2-4 GHz

(c) 4-8 GHz

(d) 8-12 GHz

(vii) Field strength due to space wave is

(a) Proportional to distance

(b) Inversely proportional to distance

(c) Inversely proportional to square of distance

(d) Not a function of distance

(viii) Ground wave propagation requires

(a) High transmitter power

(b) High frequency

(c) Better seasonal conditions

(d) Rainy conditions

(ix) Directivity and directive gain are equal for

(a) Directional Antenna

(b) Dipole

(c) Parabolic Dish

(d) Isotropic Antenna

(x) Fresnel region is

(a) Far-field region

(b) Near-field region

(c) The region of constant field

(d) The region of no field

2. (a) Explain the wave equations in free space. (8)

(b) Explain the different types of Polarization. Also, mention the sources of different polarized EM waves. (7)

3. (a) State the properties of antenna with respect to the reciprocity theorem. (3)

(b) Explain the following antenna parameters : (9)

(i) Radiation Intensity

(ii) Directive Gain

(iii) Front to Back Ratio.

(c) Find the radiation resistance of Hertzian dipole of length $\lambda/40$. (3)

4. (a) Find the directivity of a hertzian dipole and hence find the effective area of it at a frequency of 100 MHz. (3 + 2 = 5)

(b) Prove that the radiation resistance of a half-wave dipole is 73.08 Ω. (10)

5. (a) Explain the equivalent areas of an antenna. (5)

(b) Establish the Aperture - Beam area relation. (5)

(c) If electric field at a far zone point of 5 km distance from an aerial is 10 mV/m. What is the value at a point 10 km away in the same direction? (5)

6. (a) Explain the maxima, minima and half power points directions of an array of two isotropic point sources with equal amplitude and same phase. (8)

(b) Explain the radiation pattern of 8-isotropic elements fed in-phase, spaced $\lambda/2$ apart. Also, cite the important features of resultant pattern. (7)

7. (a) Design a log-periodic antenna for the FM broadcast band using a ratio factor 0.95 and diameter equal to 0.08 λ. (5)

(b) Design a 5-element Yagi-Uda antenna to operate at 205 MHz. (5)

(c) Give the advantages, disadvantages and applications of microstrip patch antenna. (5)

8. (a) Explain the normal mode of a helical antenna. (5)

(b) Design a Helical antenna operating in axial mode that gives a directivity of 14 dB at 2.4 GHz. (5)

(c) Explain the feed systems of a parabolic reflector. (5)

9. (a) List the factors involved in the propagation of radio waves. (4)

(b) Explain the structure of ionosphere with a neat diagram. Also, derive the expression for relative dielectric constant of the ionosphere with respect to the vacuum. (7)

(c) Define : $(2 \times 2 = 4)$

(i) Radio Horizon

(ii) Sunspot Cycle
