

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST-3 EXAMINATIONS-MAY-2023

B. Tech 8<sup>th</sup> Semester (ECE)

COURSE CODE (CREDITS): 18B1WEC852 (3)

MAX. MARKS: 35

COURSE NAME: Design of Modern Antennas

COURSE INSTRUCTOR: Dr. Naveen Jaglan

MAX. TIME: 2 Hr.

*Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

1. Derive the expressions for the near and far field components of Hertz dipole? Calculate the radiation resistance and total power radiated by this antenna. [CO-1,2; 4 Marks]
2. Calculate BWFN, HPBW, direction of pattern minima, direction of nulls and phase difference b/w sources for a 4-element broadside antenna array with equal amplitude and spacing. [CO-1,4; 4 Marks]
3. Find the direction of nulls and thereafter plot the radiation patterns of  $\frac{\lambda}{2}$ ,  $\lambda$ ,  $\frac{3\lambda}{2}$ ,  $2\lambda$  length dipole antennas. [CO-3,4; 4 Marks]
4. Derive and explain antenna reciprocity theorem. What are the limitations of this theorem? [CO-1,2; 3 Marks]
5. A small dipole of length  $0.1 \lambda$  is excited with a peak current of 5 Amperes. How much power will be radiated by the antenna? [CO-3,4; 3 Marks]
6. Explain the concept of Binomial antenna array. What are the advantages of Dolph-Tchebyscheff antenna array over Binomial antenna array? [CO-4,5; 4 Marks]
7. Explain the concept of frequency independent antennas. Describe the working principle of log-periodic antenna considering transmission region, active region and reflective region. [CO-4,5; 4 Marks]
8. Determine Dolph-Tchebyscheff current distribution for the maximum beam width of a linear in phase broadside array of eight isotropic sources. The spacing b/w the elements are  $\frac{3\lambda}{4}$  and the side lobe level is 40 dB down. What is the half power beam width? [CO-3,4; 3 Marks]

9. A Z-oriented Hertz dipole of length 10 cm is excited with a sinusoidal current of amplitude 20 A and Frequency 10 MHz. Find the instantaneous electric field at a distance of 1 meter along the x-axis at 1 micro second. Also, find the orientation of Electric field.

[CO- 4,5; 3 Marks]

10. What is the maximum power received at a distance of 0.5 km over a free space 1 GHz circuit consisting of a transmitting antenna with a 25 dB gain and a receiving antenna with a 20 dB gain? The gain is with respect to lossless isotropic source. The transmitting antenna input is 150W.

[CO-3,4; 3 Marks]