JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST-3 EXAMINATION-2025

M.Tech-2nd Semester (ECE)

COURSE CODE (CREDITS): 21M1WEC243 (3)   MAX. MARKS: 35

COURSE NAME: Antenna Theory and Techniques

COURSE INSTRUCTORS: Dr. Naveen Jaglan   MAX. TIME: 2 Hours

Note: (a) *All questions are compulsory.*

(b) *The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems.*

Q.No	Questions	CO	Marks
Q1	Determine the angular positions of radiation nulls and generate the E-plane radiation patterns for center-fed dipole antennas with electrical lengths of $\lambda/2$, λ, $3\lambda/2$, and 2λ.	2	3
Q2	Derive the analytical expressions for the electric and magnetic field components of a Hertzian dipole in both the near-field and far-field regions. Subsequently, compute the radiation resistance and evaluate the total radiated power of the antenna.	1	3
Q3	What is the fundamental objective of employing antenna arrays? Discuss how inter-element spacing, relative excitation amplitude, and phase shift affect the resultant radiation pattern in a Hertzian dipole array.	3	3
Q4	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.	3	3
Q5	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.	2	3

Q6	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?	3	5
Q7	A low frequency transmitting antenna has a radiation resistance of 0.5Ω and a total loss resistance of 2.5Ω. Calculate the radiated power, power input and antenna efficiency if the current fed in antenna is 100A.	2	2
Q8	Explain the concept of Binomial antenna array. What are the advantages of Dolph-Tchebyscheff antenna array over Binomial antenna array? 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?	4	3
Q9	A parabolic dish antenna has a diameter of 1.2 meters and operates at a frequency of 10 GHz. The aperture efficiency is 60%. Calculate the following: a) The operating wavelength b) The gain of the antenna in dBi c) The half-power beamwidth (HPBW) of the antenna d) The effective aperture area of the antenna	4	5
Q10	Explain the working principle of a log-periodic antenna, and discuss why it is categorized as a frequency-independent antenna. Compare it with a conventional narrowband resonant antenna like a dipole. Then, calculate the range of frequencies over which a log-periodic antenna operates if it has: Scale factor (tau) = 0.9, Apex angle = 60 degrees, longest element length = 1.5 meters and shortest element length = 0.3 meters.	4	5