


Name:			
Enrolment No:			
<b>UPES</b> <b>End Semester Examination, May 2023</b>			
<b>Course: Electromagnetic Waves and Antenna</b> <b>Program: B.Tech (ASE+AVE)</b> <b>Course Code: ECEG 3014</b>		<b>Semester : VI</b> <b>Time : 03 hrs.</b> <b>Max. Marks: 100</b>	
<b>Instructions: Attempt all questions.</b>			
<b>SECTION A</b> <b>(5Qx4M=20Marks)</b>			
S. No.		Marks	CO
Q 1	Describe V antenna and explain its principle of operation.	4	CO 5
Q 2	Briefly describe the various layers of the earth's atmosphere.	4	CO 3
Q 3	The radiation intensity of an antenna is given by: $U(\theta, \phi) = 2\cos\theta \text{ W/sr for } 0 < \theta < \frac{\pi}{2}, \quad 0 < \phi < 2\pi$ and zero elsewhere. Find total radiated power.	4	CO 1
Q 4	In free space $\vec{E}(z, t) = 50 \cos(\omega t - \beta z) \hat{a}_x \text{ V/m}$ . Find the average power crossing a circular area of radius 2.5 m in the plane $z = \text{constant}$ .	4	CO 2
Q 5	For the array of two infinitesimal horizontal dipole, find the nulls of the total field when $d = \lambda/4$ and $\beta = 0$ .	4	CO 4
<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
Q 6	Derive the expression of the array factor of an N-element uniform linear array.	10	CO 4
Q 7	Define and derive the expression of critical frequency and maximum usable frequency regarding ionospheric wave propagation.	10	CO 3
Q 8	Explain how Ampere's law is inconsistent for the time-varying fields and derive the expression for the modified Ampere law.	10	CO 2
Q 9	Explain the operation of the Yagi-Uda antenna with suitable diagram. Or Explain the design and operation of the helical antenna in both normal and axial mode.	10	CO 5
<b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b>			
Q 10	Attempt any two questions. (a) Derive wave equation starting from Maxwell's equation for free space.	10+10	CO 3

	(b) What is a uniform plane wave? Describe its properties, both physically and mathematically. (c) State and proof Poynting Theorem.		
Q 11	Write a short note on the following: (a) Radiation pattern of an antenna (b) Radiation Power Density (c) Antenna Efficiency	<b>10+5+5</b>	<b>CO 1</b>