Name: **Enrolment No:**	

UPES

End Semester Examination, December 2024

Course: Antenna and Wave Propagation **Semester: V**

Program: B. Tech Electronics and Communication Engineering **Time: 03 hrs.**

Course Code: ECEG-3041 **Max. Marks: 100**

Instructions: answer all the questions

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q. 1	Define the following terms associated with the antenna. (a) Radiation pattern. (b) Field pattern. (c) Directivity (d) Polarisation.	**4**	**CO1**
Q. 2	What are the various ionospheric layers and provide a definition of the maximum usable frequency for ionospheric propagation.	**4**	**CO2**
Q. 3	Calculate the directivity of a horn antenna having the following specifications: Operating frequency = 3 GHz. Aperture efficiency = 60% Dimension of the horn = 2 cm × 1.5 cm	**4**	**CO2**
Q. 4	Show that the gain of a half-wave dipole is 2.15 dB more than that of an isotropic antenna.	**4**	**CO2**
Q. 5	Mention the salient features of reflector antenna in terms of its significance in very high-frequency applications.	**4**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

Q. 6	(a) An antenna element is formed by placing a folded dipole in between 2 parasitic elements. One of the elements is larger and the second one is smaller than the folded dipole. How does this combined structure help in having radiation in one direction and null in another?	**6+4**	**CO2**

	(b) Estimate the length of a Yagi Uda antenna, consisting of 7 elements, and operating at 300 MHz with the following specifications: First Director length = 0.45 λ Reflector length = 0.55 λ Interelement separator = 0.2 λ. Separation between driver and reflector = λ/4.		
Q. 7	(a) Briefly discuss the phenomenon of forward scattering propagation. (b) Determine the three-field region of antenna of maximum diameter 2 m operating at 100 MHz.	**5+5**	**CO3**
Q. 8	(a) Derive a relationship between the gain and effective aperture of an antenna. (b) A paraboloid antenna is fed with a primary dipole antenna at 10 GHz of frequency. The diameter of the paraboloid antenna is 5λ. Calculate the following quantities. (i) Gain. (ii) Effective aperture (iii) FNBWA	**10**	**CO2**
Q. 9	(a) Discuss space wave propagation. (b) A radio broadcasting link has to be established between New York and Los Angeles with the help of propagation of radio waves through an ionosphere of height 200 km with a critical frequency of 5 MHz. The distance between the two aforesaid cities are 5000 km. Determine the maximum usable frequency for this specific transmission path.	**5+5**	**CO2**
SECTION-C (2Qx20M=40 Marks)			
Q. 10	(a) A rectangular patch is designed with the following specification Height = 1.5 mm Substrate's dielectric constant = 4.4 Operating frequency = 10 GHz. Calculate the dimensions (L and W) and characteristic impedance of this antenna (b) Explain the mechanism by which a microstrip antenna radiates electromagnetic waves into space using the transmission line model.	**10+10**	**CO4**

Q. 11	(a) When a radio wave propagates in free space, it encounters transmission losses. Deduce the Friss transmission equation formula for the estimation of transmission losses. (b) A paraboloid antenna set establishes a radio link between two stations. The distance between the two stations is 100 km and the operating frequency of FM radio is 100 MHz. The power transmitter antenna is 60000 W, and the gains of the transmitting and receiving antennas are 10 dB and 20 dB respectively. Then determine the following attributes. (i) Free space loss. (ii) Effective aperture of the transmitting antenna (iii) EIRP of the transmitting antenna. (iv) Power received at the receiving antenna.	**10+10**	**CO3**