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**Presidency University**

**Bengaluru**

 **SCHOOL OF ENGINEERING**

**Makeup examination, July 2024**

**Date**: 02 JULY 2024

**Time**: 9:30AM-12:30PM

**Max Marks**: 100

**Weightage**: 50%

**Course Code**: ECE3112

**Course Name**: Antenna and microwave engineering

**Department:** Electronics and communication engineering

 **Instructions:**

1. *Read the all questions carefully and answer accordingly.*
2. *Do not write any matter on the question paper other than roll number.*

**PART A**

**Answer any FOUR Questions. Each question carries 15 marks. (4Qx 15M= 60M)**

1. Find the maximum useable frequency of transmission between two stations 500 km apart, given that electron-density of the reflecting layer is $10^{2}$ electrons/$m^{3}$ at an effective height of $240$ km. (CO4, Application)
2. Find the skip distance for waves of frequency $4.6×10^{6} $Hz at time when the maximum ionization in the E-region has a value of $1×10^{11} $electrons/$m^{3}$ at a height of $110$ km (CO4, Application)
3. An antenna has a radiation resistance and loss resistance of 72$ Ω$ and 10$ Ω$ respectively. If the power gain antenna is 28, calculate its directivity in dB. (CO1, Knowledge)

1. The beam-shape of an antenna radiation pattern is an important parameter to determine the antenna performance. Generally, the term half-power beam-width (HPBWs), which denotes the half-power points on the radiation pattern is used to make an approximate estimation of the directivity. Consider an antenna whose HPBWs in two orthogonal planes are $28^{∘}$ and $35^{∘} $. If the antenna is operating at $500$ MHz determine its effective aperture. (CO2, Comprehension)
2. What are the different types of microstrip antennas? List any four applications of such antenna. (CO1, Knowledge)
3. Can an antenna have more than 0 dB gain in all the directions? Why or why not? Draw the radiation patterns of (i) horn antenna (ii) (CO2, Comprehension)
4. Sketch the different types of horn antennas. Are these antennas omni-directional or directional? (CO2, Comprehension)

**PART B**

**Answer any TWO Questions. Each question carries 20 marks. (2Qx 20M= 40M)**

1. An antenna has 3 major elements namely: driven element, reflector, and director. It is designed to operate in very high and ultra-high frequency bands (30MHz - 3GHz) and is famous for its high gain and directivity. Identify the antenna and explain their construction very briefly. (CO1, Knowledge)
2. The ionosphere is defined as the layer of the Earth's atmosphere that is ionized by solar and cosmic radiation.
a) Describe the structure of the ionosphere.
b) Calculate the maximum single-hop distance for D, E, F1, and F2 layer if their heights are assumed to be 70, 130, 230 and 350 km respectively above the earth and the angle of incidence is $15^{∘}$  in all cases.
c) Explain the process of ionospheric propagation using the refraction method (CO2, Comprehension)
3. Assume a broadcasting system operating at 100MHz, employing a half-wave dipole antenna having a gain of 2.15 dB. The power supplied to the transmitting antenna is 1 kW. The minimum power to be delivered to the receiving antenna is 1nW. If the distance between two antennas is 500 km. Find the minimum gain of receiving antenna. (CO4, Application)
4. The antenna is constructed using conducting wire and is famous for circularly polarized waves. It is designed to operate in very high and ultra-high frequency bands (300 MHz - 3GHz). Identify the antenna and explain their construction with modes of operation. (CO4, Application)