

International Islamic University Chittagong (IIUC)

Department of Electronic and Telecommunication Engineering

Final Examination

Program: **B.sc (Engg.)**
 Course Code: **ETE-3649**
 Total Marks: **50**

Semester: **Spring 2022**
 Course Title: **Antenna and Propagation**
 Time: **2 Hours 30 Minutes**

(i) Answer all the questions. The figures in the right-hand margin indicate full marks.						
(ii) Course Outcomes (COs) and Bloom's Levels are mentioned in additional Columns.						
Course Outcomes (COs) of the Questions						
CLO1	Explain different antenna parameters and their use while designing an antenna.					
CLO2	Understand the basic Working Principle of different antennas and antenna arrays.					
CLO3	Design various antennas and arrays to meet the stated specifications in terms of antenna parameters					
CLO4	Explain how different types of waves propagate through atmosphere and atmospheric effect on them					
Bloom's Levels of the Questions						
Letter Symbols	R	U	Ap	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

PART A

(Answer any two questions)

- Q1.** a) Explain why Cylindrical Dipole antenna is more broadband than Half Wave Dipole antenna. **CLO2 Ap 2**
- b) As an antenna engineer, you are given a choice to choose between Rhombic antenna and V antenna. Size of the antenna is of no concern. Antenna should be bi-directional and high directivity is required. Choose an antenna. Defend your choice with proper justification. **CLO2 E 3**
- c) Differentiate between Travelling wave and Standing wave antenna. **CLO2 An 2**
- d) Design a Rhombic Antenna to operate at a frequency of 30MHz, with the angle of elevation of 30° with respect to ground. **CLO3 C 3**
- Q2.** a) Which of the following slots will radiate and why? **CLO2 An 5**

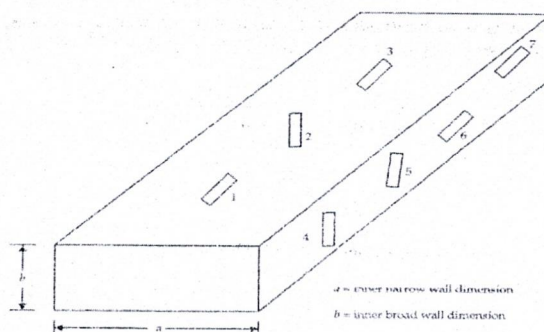


Fig. 7.34 Slot configurations in a waveguide

- b) Design a log periodic antenna to obtain a gain of 9dB and to operate over a frequency range of 125MHz – 500MHz. **CLO3 C 5**

$$\tau = 0.861$$

$$\sigma = 0.162$$

OR

Q2.	a)	Explain Spillover Efficiency of Parabolic Reflector.	CLO2	U	2
	b)	Explain the similarities and dissimilarities between the analysis of Slot antenna and Dipole antenna.	CLO2	An	3
	c)	Design a rectangular microstrip antenna using a substrate (RT/duroid 5880) with dielectric constant of 2.2, $h = 0.1588$ cm (0.0625 inches) so as to resonate at 10 GHz.	CLO3	C	5

PART B

(Answer any three questions)

Q3.	a)	Differentiate between Plane Wave, Uniform Plane Wave and Non-Uniform Plane Wave.	CLO4	U	3
	b)	Evaluate the applications of waves at different frequency ranges.	CLO4	An	4
	c)	Explain why the information about different layers of atmosphere is necessary with respect to wave propagation.	CLO4	U	3
Q4.	a)	Explain the effect of curvature of earth on Ground Wave Propagation.	CLO4	U	2
	b)	Explain what happens to magnitude and phase of reflection co-efficient for ground reflection for vertical polarization with proper figure.	CLO4	An	5
	c)	Why are Ground Waves normally Vertically Polarized?	CLO4	U	3
Q5.	a)	Derive an Expression for measuring Field Strength of Space Wave Propagation.	CLO4	An	5
	b)	A transmitter operating at 1MHz is required to provide a ground wave field strength of 1mV/m at a distance of 20km. A short vertical transmitting antenna has an efficiency of 60%, $\sigma = 4 \times 10^{-5}$ and $\epsilon_r = 15$. Determine the transmitted power required.	CLO4	Ap	5

OR

Q5.	a)	Derive an expression for refractive index of Ionosphere with respect to Electron Density of different layers of Ionosphere.	CLO4	An	2+3
	b)	Determine the relative permittivity and critical frequencies of D, E and F layers of Ionosphere for an EM wave of frequency 30MHz. (CO4) The Electron Density of D Layer = 400 electrons/cm ³ The Electron Density of E Layer = 5×10^5 electrons/cm ³ The Electron Density of F Layer = 2×10^6 electrons/cm ³ If the electron density of each layer is reduced by X% what happens to the relative permittivity and critical frequencies of respective layers? [X = Last Two digits of your Matric ID]	CLO4	Ap	5