International Islamic University Chittagong (IIUC)

Department of Electronic and Telecommunication Engineering

Final Examination

Program: **B.sc (Engg.)**
Course Code: **ETE-4745**
Total Marks: **50**

Semester: **Spring 2023 and Autumn 2022**
Course Title:**Satellite Communications**
Time:**2 Hour 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	
CO1	Define orbital mechanics and launch methodologies.
CO2	Describe satellite subsystems.
CO3	Compare competitive satellite services and explain satellite access techniques.
CO4	Design link power budget for satellites.

Bloom's Levels of the Questions						
Letter Symbols	**R**	**U**	**Ap**	**An**	**E**	**C**
Meaning	Remember	Understand	Apply	Analyse	Evaluate	Create

PART-A					
Q1	a)	Explain about Cross-Polarization Discrimination (XPD)	U	CO3	3
	b)	What is rain rate of 0.001%? How it is related to specific rain attenuation?	R	CO3	3
	c)	What is depolarization? Explain how depolarization is caused by rain?	Ap ,E	CO3, CO4	4
		OR			
		A satellite downlink at 12 GHz operates with a transmit power of 6 W and an antenna gain of 48.2 dB. Calculate the EIRP in dBW.			
Q2	a)	What is Carrier to Noise Ratio (CNR)? Discuss the various types of transmission losses in space communication.	U	CO4	4
	b)	The range between a ground station and a satellite is 42,000 km. Calculate the free-space loss at a frequency of 6 GHz.	E	CO4	3
	c)	In a link-budget calculation at 12 GHz, the free-space loss is 206 dB, the antenna pointing loss is 1 dB, and the atmospheric absorption is 2 dB. The receiver [G/T] is 19.5 dB/K, and receiver feeder losses are 1 dB. The EIRP is 48 dBW. Calculate the carrier-to-noise spectral density ratio.	E	CO4	3
PART-B					
Q3	a)	Define the following terms (i) Guard time (ii) Carrier and bit-timing recovery	R	CO3	3

		(iii)Burst code word			
	b)	Describe Spade systems with suitable diagram.	U	CO3	4
	c)	Calculate the frame efficiency for an INTELSAT frame given the following information: Total frame length = 120,832 symbols; Traffic bursts per frame =14; Reference bursts per frame =2; Guard interval = 103 symbols; Guard time (G) (64 symbols minimum); Carrier and bit-timing recovery (CBR)=176 ; Unique word (UW)= 24; Teletype (TTY)=8; Service channel (SC)=8; Voice order wire (VOW) =32; Coordination and delay channel (CDC)= 32	E	CO3	3
		OR			
	c)	Sketch and explain diagram of Satellite switching TDMA system for three spot beams.	Ap	CO3	3
Q4	a)	Explain the process of VSAT technology	U	CO3	5
	b)	Describe the network configuration of VSAT	Ap	CO3	5
Q5	a)	Describe the GPS position location principles with suitable block diagram.	An	CO3	5
	b)	Write some merits and demerits of using satellites in LEOS, MEOS, and GEOS for mobile satellite communications.	**CL O4**	**U/R**	**5**