

# International Islamic University Chittagong (IIUC)

## Department of Electronic and Telecommunication Engineering

### Mid Term Examination

Program: B.sc (Engg.)  
Course Code: ETE-4745  
Total Marks: 30

Semester: Spring 2023 and Autumn 2023  
Course Title: Satellite Communication  
Time: 1 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.

- CO1 Define orbital mechanics and launch methodologies.  
CO2 Describe satellite subsystems.

#### Bloom's Levels of the Questions

Bloom's Levels of the Questions							
Letter Symbols	R	U	Ap	An	E	C	
Meaning	Remember	Understand	Apply	Analyse	Evaluate	Create	
a)	Make a list of frequency band designations in Satellite Communication				R	CO1	2
b)	Calculate the apogee and perigee heights for the orbital parameters. Assuming a mean earth radius of 6371 km, Eccentricity = 0.0011501				Ap	CO1	4
c)	Describes the orbital parameters for the earth orbiting satellite.				U	CO1	4
a)	Write down the three conditions are required for an orbit to be geostationary.				U	CO1	3
b)	Describes the need of satellite communication over ground and sky wave propagation				U	CO1	3
c)	Determine the limits of visibility for an earth station situated at mean sea level, at latitude 48.42° north, and longitude 89.26 degrees west. Assume a minimum angle of elevation of 5°.				E	CO2	4
a)	What is the uplink and downlink frequency?				R	CO2	2
b)	Consider an earth station located in Washington DC and a GSO satellite located at 97° W. The input parameters are Earth Station: Washington DC, its Latitude=39°N, Longitude=77°W, Altitude=0 km and Satellite:Latitude=0° (inclination angle = 0), Longitude=97°W, Equatorial Radius = 6378.14 km, Geostationary Radius=42164.17 km, Geostationary Height=35786 km, Eccentricity of the earth=0.08182. Find the range, the elevation angle, and the azimuth angle to the satellite. (Hints in Appendix)				E, Ap	CO2	8
	OR A geostationary satellite is located at 90°W. Calculate the range, azimuthal and elevation angle for an earth-station antenna at latitude 35°N and longitude 100°W; average radius=6371 km, Geostationary Radius=42164km(Hints in Appendix)						

## Appendix

$$l = \left( \frac{r_e}{\sqrt{1 - e_e^2 \sin^2(L_E)}} + H \right) \cos(L_E)$$

$$z = \left( \frac{r_e (1 - e_e^2)}{\sqrt{1 - e_e^2 \sin^2(L_E)}} + H \right) \sin(L_E)$$

$$\theta = \cos^{-1} \left( \frac{r_e + h_{\text{CSO}}}{d} \sqrt{1 - \cos^2(B) \cos^2(L_e)} \right)$$

$$d = \sqrt{R^2 + a_{\text{CSO}}^2 - 2Ra_{\text{CSO}} \cos b}$$