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Mid Term Examinations - October 2026

Date: 05/10/2026 **Time:** 11:45 AM - 01:15 PM

Course Code: ECE3055 **Course Name:** Satellite Communication

Semester: Seventh Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2
Marks	34	56

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	Definition • The equivalent power radiated by an isotropic antenna that would produce the same signal strength as the actual transmitting antenna. • 2m	2	CO2	BT1
2	equatorial.inclined,polar 2M	2	CO1	BT1
3	Definition:An **absorptive network** is a passive microwave network that absorbs incident power rather than reflecting it. 2M	2	CO2	BT1
4	definition: • **Definition:** The **system noise temperature** represents the equivalent input noise temperature of a chain of amplifiers connected in cascade. It accounts for the noise contribution of each stage, reduced by the gain of preceding stages. **Relevant Equation (Friis Formula for Noise in Cascades)** For n amplifiers in cascade: $T_{sys}=T1+T2G1+T3G1\cdot G2+\cdots+TnG1\cdot G2\cdot\ldots\cdot Gn-1$ Where: • Tsys = System noise temperature • T1,T2,...,Tn = Noise temperatures of each amplifier stage • G1,G2,...,Gn−1 = Gains of preceding amplifier stages 2M	2	CO2	BT1
5	definition :satellite graveyard (or graveyard orbit) is a disposal orbit located about 300 km above the geostationary belt, where retired satellites are moved at the end of their operational life to keep the active geostationary orbit clear of debris. 2M	2	CO1	BT1

PART B : Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT

ANSWER KEY

6	1. **Equatorial Satellites** ◦ Orbit directly above the Earth's equator. ◦ Often geostationary (appear fixed relative to Earth). ◦ Used for communication, broadcasting, and weather monitoring. 2M 2. **Polar Satellites** ◦ Orbit passes over both poles. ◦ Covers the entire Earth as the planet rotates beneath. ◦ Commonly used for Earth observation, remote sensing, and reconnaissance. 2M 3. **Inclined Satellites** ◦ Orbit tilted at an angle relative to the equator. ◦ Not geostationary; trace a north–south path across Earth. ◦ Useful for regional coverage where equatorial satellites are less effective. 2M **Definitions** **a) Atmospheric Drag** • The resistive force experienced by satellites due to the thin atmosphere at lower altitudes. • Causes gradual orbital decay, especially for **low Earth orbit (LEO)** satellites below ~1,000 km. • Reduces velocity and altitude over time, requiring orbit corrections. 2M **b) Satellite Graveyard** • A **graveyard orbit** is a disposal orbit located about 300 km above the geostationary belt. • Retired satellites are moved here at end-of-life to avoid collisions in the active GEO region. 2M • • Satellites are "passivated" (fuel vented, batteries discharged) to prevent explosions and debris creation.	10	CO1	BT2
7	a)34,000km e=0.62-- 5m b)T1=1.53T2 ----5M	10	CO1	BT3

PART C: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
8	2 types effects of non spherical earth and atmospheric drag • **Non-spherical Earth effects:** (i) Regression of nodes (RAAN drift), (ii) Rotation of line of apsides (perigee shift).explain 5M • **Atmospheric drag effects:** (i) Orbital decay, (ii) Reduced satellite lifetime due to energy loss. 5M explain	10	CO2	BT2

ANSWER KEY

9	3 laws : **1. Kepler's First Law (Law of Ellipses)** • **Statement:** Every satellite moves in an elliptical orbit with the Earth at one of the foci. • **Explanation:** Satellite paths are not perfect circles; they are ellipses. The Earth is located at one focus of the ellipse. • **Significance:** Defines the geometric shape of satellite orbits. 3M **2. Kepler's Second Law (Law of Equal Areas)** • **Statement:** A satellite sweeps out equal areas in equal intervals of time. • **Explanation:** The satellite moves faster when it is closer to Earth (perigee) and slower when farther away (apogee). • **Significance:** Explains variation in orbital speed depending on distance from Earth. 3M **3. Kepler's Third Law (Law of Periods)** • **Statement:** The square of the orbital period of a satellite is proportional to the cube of the semi-major axis of its orbit. • **Equation:** $T^2 \propto a^3$ Where: • T = orbital period • a = semi-major axis of the orbit • **Significance:** Relates the time taken for one revolution to the size of the orbit. Larger orbits mean longer periods. 4M	10	CO2	BT2

PART D: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
10	**Carrier-to-Noise Ratio (CNR) Definition** • **CNR** is the ratio of the received carrier power to the noise power in the communication system. • It is a key metric in link budget analysis, determining the quality and reliability of the satellite link. 5M CNR=CN • Noise power depends on the **system noise temperature** of the satellite receiver. $(CN)_{uplink} = EIRP_{earth} + G_{sat} - L_{path}\ k \cdot T_{sys,sat} \cdot B$ 5M	10	CO2	BT3

ANSWER KEY

11	RLV ELV explain **RLV – Reusable Launch Vehicle 2M** • **Definition:** A launch vehicle designed to be recovered and reused for multiple missions. • **Features:** ◦ Equipped with wings, landing gear, or vertical landing capability. ◦ Reduces cost per launch by reusing major components (boosters, stages). ◦ Example: **SpaceX Falcon 9**, ISRO's RLV-TD. • **Advantages:** ◦ Cost-effective in the long run. ◦ Environmentally sustainable (less space debris). ◦ Faster turnaround between launches. **ELV – Expendable Launch Vehicle 3M** • **Definition:** A launch vehicle that can be used only once; its components are discarded after launch. • **Features:** ◦ Traditional rocket design. ◦ All stages either burn up in the atmosphere or remain as space debris. ◦ Example: **Ariane 5**, ISRO's PSLV, GSLV. • **Advantages:** ◦ Simpler design, proven reliability. ◦ No need for recovery systems. ◦ block diagram 3M ◦ explanantion 2M ◦	10	CO1	BT2

ANSWER KEY

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	4 types of losses and explanation Free-Space Path Loss (FSPL) 2M Atmospheric Losses 3M Polarization Loss 2M Antenna Misalignment Loss 3M • • 	10	CO2	BT2

13	**Power Density at Distance d** If a transmitter radiates power Pt with antenna gain Gt, the **power density** at distance d i The receiving antenna with effective aperture Ae collects part of this power: Pr=S·Ae But the effective aperture is related to antenna gain Gr and wavelength λ: Ae=Grλ24π 5M **Friis Transmission Equation** Pr=PtGtGr(λ4πd)2 5M	10	CO2	BT3

ANSWER KEY