MUST KNOW CONCEPTS	MKC

ECE	2021-22

Course Code & Course Name   :   19ECE15 & SATELLITE COMMUNICATION

Year/Sem/Sec   :   III / V / A, B

S.No.	Term	Notation (Symbol)	Concept / Definition / Meaning / Units / Equation / Expression	Units
			UNIT 1: INTRODUCTION TO SATELLITE COMMUNICATION	
1.	Satellite	-	An artificial body placed in orbit round to collect information or for communication.	-
2.	Kepler's First Law	-	The path followed by a satellite around the primary will be an ellipse.	-
3.	Kepler's second law	-	For equal time intervals, a satellite will sweep out equal areas in its orbital plane, focused at the barycenter.	-
4.	Kepler's third law	-	The square of the periodic time of orbit is proportional to the cube of the mean distance between the two bodies.	-
5.	Newton's First Law	-	Newton's First Law of Motion - if an object is at rest, it takes un- balanced forces to make it move.	-
6.	Orbital elements	-	Orbital elements are the parameters required to uniquely identify a specific orbit.	-
7.	Geostationary Orbit	-	A satellite orbits the earth at exactly the same speed as the earth turns and at the same latitude, specifically zero, the latitude of the equator.	-
8.	Sub satellite Point	-	Point at which a line between the satellite and the center of the Earth intersects the Earth's surface Location of the point expressed in terms of latitude and longitude.	-
9.	Orbital Parameters	-	- Semi major axis. - Eccentricity. - Mean anomaly. - Argument of perigee. - Inclination. - Right ascension of ascending node.	-

10.	Eclipse	-	It occurs when Earth's equatorial plane coincides with the plane of the Earth's orbit around the sun.	-
11.	Limits of visibility	-	The east and west limits of geostationary are visible from any given Earth station.	-
12.	Telemetry Tracking and Command Systems	-	Systems of a spacecraft provides the most vital telecommunication link between a satellite and ground station.	-
13.	Look Angles	-	Azimuth angle and Elevation angle.	-
14.	Azimuth Angle	-	The angle between local horizontal plane and the plane passing through earth station, satellite and center of the earth.	-
15.	Elevation Angle	-	The angle between vertical plane and line pointing to satellite.	-
16.	Satellite Launch Vehicle Modules	-	Propulsion systems, Auto Piloting, Aerodynamic structure, Interactive Steering subsystem	-
17.	Orbit Stages For Satellite Launch	-	• Circular low earth orbit • Hohmann elliptical transfer orbit • Intermediate drift orbit • Circular Geostationary orbit	-
18.	Types of satellite launch vehicles.	-	• Expendable Launch Vehicles (ELV) • Reusable Launch Vehicles (RLV)	-
19.	Expendable Launch Vehicles	-	It get destroyed after leaving the satellites in space	-
20.	Reusable Launch Vehicles	-	It can be used multiple times for launching satellites	-
21.	Launching Problems	-	Vibration Emission of Gases, Weather at launching time and Error during Countdown	-
22.	Apogee	-	The point farthest from the earth.	-
23.	Perigee	-	The point closest from the earth.	-
24.	Power subsystem in satellite	-	The Electric Power Subsystem (EPS) of a satellite is a heavy and expensive subsystem. It is often about 25% of the weight and 25% of the cost of a spacecraft.	-
25.	Communication subsystem	-	It responsible for ensuring telecommunication between the satellite and another system, which may be either another satellite or a ground station	-
UNIT 2: SATELLITE LINK DESIGN				
26.	Payload	-	The equipment used to provide the service for which the satellite has	-

			been launched.	
27.	Transponder	-	Connecting link between the satellite's transmit and receive antennas.	-
28.	LNA	-	Low-noise amplifier adds little noise to the carrier being amplified.	-
29.	Noise temperature	-	Antenna noise temperature is a measure of all noise that enters a receiver through its antenna.	-
30.	Command	-	Receives command signals from the earth station, often in response to telemetered information.	-
31.	TWTAs	-	Traveling-wave tube amplifiers are used in transponders to provide the final output power required to the transmit antenna.	-
32.	EIRP	-	Equivalent Isotropic Radiated Power may be thought of as the power input to one end of the transmission link, and the problem is to find the power received at the other end.	-
33.	RFL	-	Receiver Feeder Losses will occur in the connection between the receive antenna and the receiver proper.	-
34.	Transmission losses	-	The difference between the power sent at one end and received at the receiving station is known as Transmission losses	-
35.	Antenna misalignment loss	-	It can happen when any physical object interferes with and prevents proper radio frequency propagation	-
36.	Uplink	-	The earth station is transmitting the signal to the satellite.	-
37.	Pitch angle	-	Movement of a spacecraft about an axis which is perpendicular to its longitudinal axis.	-
38.	Noise figure	-	Noise Figure is defined as the ratio of signal to noise ratio at the output to that at the input. In other words, NF= (s/n)i/(s/n)o.	-
39.	Yaw	-	The rotation of a vehicle about its vertical axis.	-
40.	SNR	-	Signal to Noise Ratio introduced in the preceding section is used to refer to the ratio of signal power to noise power at the receiver output.	-
41.	Downlink	-	The satellite is transmitting the signal to the earth station.	-
42.	Received Power	[PR] = [EIRP] x [GR] - [LOSSES]	[PR] --> Received Power, dBW [EIRP] --> Equivalent Isotropic Radiated Power, dBW	-

			[GR] --> Received antenna Gain, dB	
43.	Tracking	-	Track the satellite's movement and send correction signals as required	-
44.	Noise Factor	-	An alternative way of representing amplifier noise is by means of its noise factor.	-
45.	Link-Power Budget	-	Calculations take into account all the gains and losses from the transmitter, through the medium to the receiver in a telecommunication system.	-
46.	Momentum Bias	-	Spin stabilization may be achieved with cylindrical satellites.	-
47.	Angle of Tilt	-	The angle a rocket makes with the vertical as it curves along its trajectory.	-
48.	Inclination	-	The angle between the orbital plane and the Earth's equatorial plane.	-
49.	G/T ratio	-	G/T is the figure of merit for a satellite system. G is the Receive antenna gain. T is the system noise temperature.	-
50.	Ionospheric losses	-	Satellite signals are disturbed by atmospheric effects on the path between the satellite and the receiver antenna. These effects are mostly rain, cloud and gaseous attenuation.	-
UNIT 3: EARTH SEGMENT				
51.	ODU and IDU	-	ODU- The home receiver outdoor unit IDU- The home receiver indoor unit.	-
52.	MATV System	-	Master Antenna TV system. It is used to provide reception of DBS TV channels to the user group.	-
53.	CATV	-	Community Antenna TV system. It consists of one outdoor unit and separate feeds for each sense of polarization.	-
54.	TVRO	-	TV receive-only (TVRO) systems, and the most complex are the terminal stations used for international communications networks.	-
55.	Feed System	-	The feed along with the reflector is the radiating/receiving element of electromagnetic waves.	-
56.	Noise weighting	-	The method used to improve the post detection signal to noise ratio is referred to as noise weighting.	-

57.	Antenna Reflector	-	The main antenna for the earth stations because of the high gain available from the reflector and the ability of focusing a parallel beam into a point at the focus where the feed is located	-
58.	Noise power spectral density	-	Noise power per unit Bandwidth is termed as the noise power spectral density.	-
59.	Antenna Mount	-	Determined mainly by the coverage requirement and tracking requirements of the antenna systems	-
60.	Antenna loss	-	It is added to noise received as radiation and the total antenna noise temperature is the sum of the equivalent noise temperature of all these sources.	-
61.	Noise factor	-	An alternative way of representing amplifier noise.	-
62.	Saturation flux density	-	The flux density required at the receiving antenna to produce saturation of TWTA.	-
63.	Component of earth station	-	Transmitter, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power, Test Equipments	-
64.	CNR	-	Carrier to Noise Ratio is the signal-to-noise ratio (SNR) of a modulated signal.	-
65.	Tracking	-	How efficiently it points the antenna beam to the satellite both in the transmit and receive mode	-
66.	On step-by-step technique	-	Maximum reception of the received signal is needed and it is performed by moving and checking the beam continuously.	-
67.	MATV	-	Master Antenna TV system is used to provide reception of DBS TV/FM channels to a small group of users	-
68.	CATV	-	Community Antenna TV system employs a single outdoor unit, with separate feeds available for each sense of polarization	-
69.	Y factor	-	$Te = (Tb-YTc)/(Y-1)$ Te- Receiver excess noise Tb – hot noise Tc –cold noise	-
70.	Cassegrain	-	A common dual reflector antenna called Cassegrain has a convex sub reflector positioned in front of the main dish, closer to the dish than the focus.	-

71.	Gregorian	-	This system has a concave secondary reflector located just beyond the primary focus. This also bounces the waves back toward the dish.	-
72.	Types of antenna mount	-	• The Azimuth –elevation mount The X-Y mount	-
73.	Earth Station's tracking system	-	• Satellite acquisition • Automatic tracking • Manual tracking • Program tracking.	-
74.	Antenna Gain	-	Ratio of the power produced by the antenna from a far-field source on the antenna's beam axis to the power produced by a hypothetical lossless isotropic antenna.	-
75.	Voice	-	Telephone Speech signals	-
UNIT 4: SATELLITE ACCESS					
76.	Digital Video Broadcasting	-	It is a set of standards that define digital broadcasting using existing satellite, cable, and terrestrial infrastructures	-
77.	Multiple Access Techniques	-	FDMA – Frequency Division Multiple Access Techniques TDMA – Time Division Multiple Access Techniques CDMA - Code Division Multiple Access	-
78.	FDMA	-	Each user is allocated a unique frequency band or channel.	-
79.	TDMA	-	Only one carrier uses the transponder at any one time.	-
80.	CDMA	-	Each signal is associated with a particular code that is used to spread the signal in frequency and time.	-
81.	Types of CDMA	-	• Spread Spectrum Multiple Access • Pulse Address Multiple Access	-
82.	SCPC	-	Single Channel Per Carrier refers to using a single signal at a given frequency and bandwidth.	-
83.	Thin route service	-	SCPC systems are widely used on lightly loaded routes.	-
84.	Feature of Intelsat SCPC system	-	The system is that each channel is voice activated. This means that on a two way telephone conversation only one carriers is operative at any one time.	-

85.	SPADE System	-	single-channel-per-carrier pulse-code-modulated multiple-access-demand-assignment equipment.	-
86.	Guard time	-	It is necessary to prevent the bursts from overlapping.	-
87.	Decoding quenching	-	The phase detector must be allowed for some time to recover from one burst before the next burst is received by it.	-
88.	Direct closed loop feedback	-	The timing positions are reckoned from the last bit of the unique word in the preamble.	-
89.	Feedback closed loop control	-	The synchronization information is transmitted back to an earth station from a distant.	-
90.	Frame efficiency	-	It is measure of the fraction of frame time used for the transmission of traffic.	-
91.	Digital speech interpolation	-	The point is that for a significant fraction of the time, the channel is available for other transmission and advantages are taken of this in a form of demand.	-
92.	Switched TDMA	-	Space Division Multiplexing can be realized by switching the antenna interconnections in synchronism with the TDMA frame rate.	-
93.	Processing gain	-	The jamming or interference signal energy is reduced by a factor known as the processing gain.	-
94.	Burst code word	-	It is a binary word, a copy of which is stored at each earth station.	-
95.	Modulation	-	Modification of a carrier's parameters (amplitude, frequency, phase, or a combination of them) in dependence on the symbol to be sent.	-
96.	Multiplexing	-	Sender (s) and Receiver (s) they want to exchange data one of several constellations of a carrier's parameters.	-
97.	Digital modulation	-	Transmitting digital data are digitized analog signals may conveniently share a channel with digital data, allowing a link to carry a varying mix of voice and data traffic	-
98.	FDM	-	Divide the frequency spectrum into smaller subchannels, giving each user exclusive use of a subchannel (e.g., radio and TV).	-
99.	Frequency reuse	-	The satellite as a whole to be accessed by earth stations widely	-

			separated geographically but transmitting on the same frequency	
100.	Earth segment	-	Earth segment of a satellite communication system consists of transmit earth station and receive earth station.	-
UNIT 5 : SATELLITE APPLICATIONS				
101.	INTELSAT	-	International Telecommunications Satellite.	-
102.	INSAT	-	Indian National Satellite System	-
103.	VHRR	-	Very High Resolution Radiometer	-
104.	Satellite Services	-	- INSAT-3D - INSAT-3E - KALPANA-1 - Edusat - GSAT-2 - INSAT-4A	-
105.	VSAT	-	Very Small Aperture Terminal	-
106.	DAMA	-	Demand Assigned Multiple Access	-
107.	VSAT Applications	-	Supermarket shops, Chemist shops, Broadband direct small business,	-
108.	Mobile satellite services	-	GSM, GPS	-
109.	Three Segments of GPS	-	Space Segment, Control Segment, User Segment	-
110.	INMARSAT	-	Indian Maritime Satellite	-
111.	DBS	-	Direct Broadcast satellites	-
112.	DTH	-	Direct to home Broadcast (DTH)	-
113.	DAB	-	Digital audio broadcast	-
114.	Worldspace services	-	GRAMSAT satellites, keeping in mind the urgent need to eradicate illiteracy in the rural belt which is necessary for the all round development of the nation.	-
115.	Specialized services	-	Satellite-email services, Video Conferencing, Satellite Internet access	-
116.	Dom sat	-	Domestic Satellites. These are used for voice, data and video transmissions within the country	-
117.	SARSAT	-	Search and rescue satellite.	-
118.	Applications of Radarsat	-	- Shipping and fisheries. - Ocean feature mapping. - Iceberg detection - Crop monitoring	-
119.	ECEF	-	The geocentric equatorial coordinate system is used with the GPS system. It is called as earth centered, earth	-

			fixed coordinate system.	
120.	PDOP	-	Position Dilution Of Precision is defined as with the GPS system, dilution of position is taken into account through a factor.	-
121.	Frequency range of US DBS systems	-	Uplink frequency range is 17.3 GHz to 17.8 GHz Downlink frequency range is 12.2 GHz to 12.7 GHz	-
122.	GCC and GEC	-	Gateway Control Centers and Gateway Earth Stations	-
123.	INSAT series	-	• INSAT-1 • INSAT-2 • INSAt-2A • INSAT-2E • INSAT-3	-
124.	Frequency Range of US DBS systems	-	• Uplink frequency range is 14 GHz to 14.5 GHz • Downlink frequency range is 11.7 GHz to 12.2 GHz	-
125.	GRAMSAT	-	It is carrying six to eight high powered C-band transponders, which together with video compression techniques and audio-visual programs.	-
Placement Questions				
126.	Hohmann Transfer Orbit	-	This is an intermediate orbit having a highly elliptical shape.	-
127.	Attitude & orbit control system (AOCS)	-	It consists of rocket motors that are used to move the satellite back to the correct orbit when an external force causes it to drift.	-
128.	Satellite Antennas	-	• Wire antennas: monopoles and dipoles • Horn antennas • Reflector antennas • Array antennas	-
129.	Passive Satellites	-	A satellite that only reflects signals from one Earth station to another or from several Earth stations to several others.	-
130.	Active Satellites	-	In active satellites, it amplifies or modifies and retransmits the signal received from the earth.	-
131.	Satellite orbits in terms of the orbital height	-	• GEO • MEO • LEO	-
132.	MEO satellites	-	The GPS constellation calls for 24 satellites to be distributed equally among six circular orbital planes	-
133.	Frequencies allocated	-	• VHF: 01-0.3 ---Mobile & Navigational Satellite	-

	to the satellites:		Services • L-band: 1.0-2.0 --- Mobile & Navigational Satellite Services C-band: 4.0-8.0 --- Fixed Satellite Service • Ku-band: 12.0-18.0 --- Direct Broadcast Satellite Services	
134.	Statistical multiplexing	-	Allocate bandwidth to arriving packets on demand.	-
135.	Digital Video Broadcasting (DVB)	-	Digital Video Broadcasting (DVB) has become the synonym for digital television and for data broadcasting world-wide.	-
136.	High Power Amplifier	-	Amplifier may work with signals of all level, depending on where they are in the signal chain	-
137.	Proposed Broadband Satellite systems	-	• Teledesic • SkyBridge • Spaceway	-
138.	Non Geostationary Orbits (NGSO)	-	• Polar Orbit • Equatorial Orbit • Inclined Orbit	-
139.	Problems of Geosynchronous Satellite Communications Systems	-	• No coverage of polar region. • Long time delay. • Echo. • Eclipse due to the earth and the sun. • Sun Transit outage	-
140.	Satellite Bus subsystems	-	• Mechanical structure • Attitude and orbit control system • Propulsion System • Electrical Power System • Tracking Telemetry and Command System • Thermal Control System	-
141.	Simplification	-	39.912 % of 79.908 + √3969.12 * 4.897 – 12.190 * 7.198 = **?** **Ans:** 263	-
142.	Profit and Percentage	-	A Shopkeeper makes 30% profit when he gives 12% discount while selling an article. At the end of the day he gives a customer 6% additional discount so that the remaining articles are sold. What will be his new approximate profit percentage? **Ans:** 21%	-
143.	Number Series	-	Find the wrong term in the following number series?	-

			4, 12, 60, 360, 2520, 20160 Ans: 4	
144.	Number Series	-	What value should come in the place of question mark in the given series? 2209, 1849, 1681, 1369, 961, 841, ? Ans: 529	-
145.	Relation ship	-	Eight persons B, E, J, K, M, S, T and V are in a family with three different generations. J is the son of B. E is the daughter of K and sister of S. M is the mother of E. V is the sister-in-law of S, who has only two siblings. S is the aunt of J. T is the niece of B. E does not has any child. **How is K related to T?** Ans: Grandfather	-
146.	Computer Awareness	-	The command to access the memory or the input/output device is carried by the _____ Ans: Control bus	-
147.	Directions	-	A man started walking from his place. He goes 5m south. He turns 90 degree anticlockwise and walks for 7m. Now he turns left and goes 3m. After turning right, he walks for 4m, again he walks for 3m after turning left. Now he turns towards west and walks for 5m. He again walks for 5m before he stops. **What is the direction of his starting point with respect to his ending point?** Ans: South	-
148.	Speed and Time	-	A train travelling at 72 km/hr crosses another train of length equivalent to five-sixth of its own length travelling in opposite direction at 60 km/hr in 9 seconds. Find the length of the second train? Ans: 150 m	-
149.	Profit and Loss	-	A, B and C entered into a partnership by investing Rs. 18000, Rs. 24000 and Rs. 30000 respectively. After 4 months, A withdraws one-third of the	-

			amount and B invested Rs. 16000 more. And after 3 months, C withdraw three-fifth of the amount. Find the total profit at the end of the year, if the share of B is Rs. 52000? **Ans:** 106750	
150.	Time and Work	-	35 men can complete a piece of work in 18 days. After 8 days from the start of the work, some men left. If the remaining work was completed by the remaining men in 14 days, then find the men left after 8 days from the start of the work? **Ans:** 10 men	-

Faculty Team Prepared   **Signatures**

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