

Sardar Patel Institute of Technology Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	Т	P	L	Т	Р	Total
ETC 802	Satellite Communication and Network	4			4			4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes	s ETC 502: Analog communication			
-	ETC 601: Digital Communication			
After successful completion of the course, student will be able to				
	CO1	Explain the basics of satellite communication		
	CO2	Explain and analyzes link budget of satellite signal for		
Course Outcomes		proper communication		
	CO3	Use the system for the benefit of society		
	CO4	Use the different application of satellite communication		

Module	Unit	Topics	Ref.	Hrs.	
No.	No.				
1	Overv	verview of Satellite Systems, Orbits and Launching			
	1.1	Frequency allocation for satellite services, system design			
		consideration, satellite services- VSAT, global positioning			
		satellite system, maritime satellite services, gateways			
	1.2	Polar orbiting satellites, Kepler's First, second and third law,			
		orbital elements, apogee, perigee heights, orbital perturbations,			
		effects of a non-spherical earth, atmospheric drag			
	1.3	Sub-satellite Point, predicting satellite position, antenna look			
		angels, polar mount antenna, limits of visibility, near			
		geostationary orbits, earth eclipse of satellite, sun transit outage			
	1.4	Selection of launching site, launch window, zero and non-zero			
		degree latitude launching, sea launch, launch vehicles; satellite			
		launch vehicle (SLV), augmented satellite launch vehicle			
		(ASLV), polar SLV, geostationary satellite launch vehicle			
		(GSLV)			
2	Space	space Segment			
	2.1	Attitude control, spinning satellite stabilization, momentum			
		wheel stabilization, station keeping, thermal control, TT and C			
		subsystem, transponders, wideband receiver, input de-			
		multiplexer, power amplifier, antenna subsystem			
	2.2	Equipment reliability and space qualification			
3	Satell	Satellite Links			
	3.1	Isotropic radiated power, transmission losses, free-space			
		transmission, feeder losses, antenna misalignment losses, fixed			



Sardar Patel Institute of Technology Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

3.2 System noise, antenna noise, anipinter noise temperature, or absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1.3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1.3 5.1 Space Segment Access and Utilization. 1.3 5.1 Space Segment Access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1.3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread spectrum-acquisition and trackling, spectrum spreading and dispreading – CDMA throughput 2.3 6.1 Satellite Network: net work reference models and protocols, layering principle, open system interconnection (OSI), reference model, IP reference model, reference architecture for satellite networks, basic characteristics of satellite networks, onboard connectivity with transparent processing, analogue transparent switc				Total	52
3.2 System noise, anemia noise, amprine noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5.1 Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, settellite switched TDMA 5.3 6.1 Satellite Network: net work reference models and protocols, layering principle, open system interconnection (OSI), reference model, IP reference model, reference architecture for satellite networks, basic characteristics of satellite networks, onboard connectivity with transparent processing, analogue transparent switching, Frame organization, Window organization, On board connectivity with beam scanning 2.3 6.			communication link		
3.2 System noise, antenna noise, anipriner noise temperature of absorptive networks, overall system noise temperature of noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread spectrum-acquisition and trackling, spectrum spreading and dispreading – CDMA throughput 2,3 6 Satellite Network: net work reference models and protocols, layering principle, open system interconnection (OSI), reference model, IP reference model, reference architecture for satellite networks, obsic characteristics of satellite networks, onboard connectivity with transparent processing, analogue transparent switching, Frame organization, Window organization, On board connectivity with transparent processing, analogue transparent swi			acquisition, tracking & positioning, deep space optical		
3.2 System noise, anemia noise, aniprite noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5.1 Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 6.1 Satellite Network: net work reference models and protocols, layering principle, open system interconnection (OSI), reference model, IP reference model, reference architecture for satellite networks, obsoard connectivity with transparent processing, analogue transparent switching, Frame organization, Window organization, On board connectivity with beam scanning 6.2 Laser Satellite Communication: Link analysis, optical satellite <th></th> <th></th> <th>link transmitter, optical satellite link receiver, satellite beam</th> <th></th> <th></th>			link transmitter, optical satellite link receiver, satellite beam		
3.2 System noise, andema noise, anipmer noise temperature, amplifiers in cascade, noise factor, noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor uni for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5.1 Space Segment Access and Utilization. 1,3 5.1 Space segment Access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, statellite switched TDMA 5,3 6 Satellite Networking 2,3 6.1 Satellite Network: net work reference models and protocols, layering principle, open system interconnection (OSI), reference model, IP reference model, reference architecture for satellite networks, basic characteristics of satellite networks, onboard connectivity with beam scanning		6.2	Laser Satellite Communication: Link analysis, optical satellite		
3.2 System noise, antenna noise, antenna noise factor, noise temperature, amplifiers in cascade, noise factor, noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoorindoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5.1 Space Segment Access and Utilization. 1,3 5.1 Space segment Access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread spectrum-acquisition and trackling, spectrum spreading and dispreading – CDMA throughput 2,3 6 Satellite Network: net work reference models and protocols, layering principle, open system interconnection (OSI), reference model, IP reference model, reference architecture for satellite networks, basic characteristics of satellite networks, onboard connectivity with transparent processing, analogue transparen			connectivity with beam scanning		
3.2 System holse, anemia holse, anjmiter holse temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoorindoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment Access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread spectrum-acquisition and trackling, spectrum spreading and dispreading – CDMA throughput 2,3 6 Satellite Network: net work reference architecture for satellite networks, basic characteristics of satellite networks, obsodrad connectivity with transpreader processing and connectivity with transpreader processing and connectivity with transpreading and connecting principle, open system interconnection (OSI), refer			switching, Frame organization, Window organization, On board		
3.2 System noise, anemia noise, anjmiter noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoorindoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preasigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread spectrum-acquisition and trackling, spectrum spreading and dispreading – CDMA throughput 2,3 6.1 Satellite Network: net work reference models and p			connectivity with transparent processing analogue transparent		
3.2 System noise, antenna noise, antenna noise, antenna noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoorindoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 6 Satellite Networking 2,3 6 Satellite Network: net work reference models and protocols, layering principle, open system interconnection (OSI), reference			model, IP reference model, reference architecture for satellite		
3.2 System noise, anemia noise, anipmer noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, demand assigned TDMA, demand assigned TDMA, stellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread spectrum-acquisition and trackling, spectrum spreading and dispreading – CDMA throughput 2,3 6 Satellite Network: net work reference models and protocols, 2,3			layering principle, open system interconnection (OSI), reference		
3.2 System noise, anemia noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 Design considerations, receive-only home TV systems, outdoorindoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 4.2 Community antenna TV systems 5 The Space Segment Access and Utilization. 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread spectrum-acquisition and trackling, spectrum spreading and dispreading – CDMA throughput		6.1	Satellite Network: net work reference models and protocols,		
3.2 System noise, amerina noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoorindoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread spectrum-acquisition and trackling, spectrum spreading and dispreading – CDMA throughput	6	Satelli	te Networking	2,3	10
3.2 System noise, antenna noise, amprifer noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoorindoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread spectrum-acquisition and trackling, spectrum spreading and			dispreading – CDMA throughput		
3.2 System noise, antenna noise, ampiniter noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA 5.3 Code Division Multiple Access: Direct-sequence spread			spectrum-acquisition and trackling, spectrum spreading and		
3.2 System noise, antenna noise, ampriner noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, satellite switched TDMA		5.3	Code Division Multiple Access: Direct-sequence spread		
3.2 System noise, america noise, ampriner noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery, network synchronization, unique word detection, traffic date, frame efficiency channel capacity preassigned			TDMA, demand assigned TDMA, satellite switched TDMA		
3.2 System noise, america noise, ampriler noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3 5.2 TDMA: Reference Burst; Preamble and Postamble, carrier recovery network synchronization unique word detection 1			traffic date, frame efficiency, channel canacity, preassigned		
3.2 System noise, america noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation 1,3		5.4	recovery network synchronization unique word detection		
3.2 System noise, antenna noise, anipinter noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT averalle for encertion.		5 2	TDMA: Reference Burst: Preamble and Postamble corrier		
3.2 System noise, antenna noise, amprifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3 5.1 Space segment access methods, pre-assigned FDMA, demand 1,3			assigned FDMA, SPADE system, bandwidth-limited and power-		
3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 5 The Space Segment Access and Utilization. 1,3		5.1	Space segment access methods, pre-assigned FDMA, demand		
3.2 System noise, america noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations 1,3 4.2 Community antenna TV systems 1	5	The S	pace Segment Access and Utilization.	1,3	08
3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations		4.2	Community antenna TV systems		
3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system,			transmit-receive earth stations		
3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station. 1,3 4.1 Design considerations, receive-only home TV systems, outdoor–			indoor unit for analog (FM) TV, master antenna TV system,		
3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise 4 Earth Station.	-	4.1	Design considerations, receive-only home TV systems, outdoor-	-,-	~ -
 3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, intermodulation noise. 	4	Earth	Station.		04
 3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output 3.4 Effects of rain, uplink rain-fade margin, downlink rain-fade margin, amplifier and downlink rain-fade 			margin, combined uplink and downlink C/N ratio, inter-		
3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output		3.4	Effects of rain, uplink rain-fade margin, downlink rain-fade		
3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station HPA,			Downlink: Output back off, satellite TWTA output		
 3.2 System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio 3.3 Uplink: Saturation flux density, input back off, earth station 		-	HPA,		
amplifiers in cascade, noise factor, noise temperature, absorptive networks, overall system noise temperature, carrier to noise ratio		3.3	Uplink: Saturation flux density, input back off, earth station		
amplifiers in cascade, noise factor, noise temperature of			absorptive networks, overall system horse temperature, carrier to		
3.4 System noise, antenna noise, ampinter noise temperature,			amplifiers in cascade, noise factor, noise temperature of		
27 System noise entenne noise emplifier noise temperature		3.2	System noise, antenna noise, amplifier noise temperature,		
atmospheric and ionospheric losses, link power budget			atmospheric and ionospheric losses, link power budget		



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India (Autonomous Institute Affiliated to University of Mumbai)

References:

1. Dennis Roddy, "Satellite Communications", 3rd Ed., Mc. Graw-Hill International Ed. 2001.

2. Wilbur L. Pritchard, Henri G. Suyderehoud, and Robert A. Nelson, "Satellite Communication systems Engineering", Pearson Publication

3. Gerard Maral and Michel Bousquet, *"Satellite Communication Systems"*, 4th Edition Wiley Publication

4. Timothy Pratt, Charles Bostian, and Jeremy Allmuti, "Satellite Communications", John Willy & Sons (Asia) Pvt. Ltd. 2004