



# 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	T	P	L	T	P	Total
ETC 802	Satellite Communication and Network	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

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

Module No.	Unit No.	Topics	Ref.	Hrs.
<b>1</b>	<b>Overview of Satellite Systems, Orbits and Launching</b>		1,2	10
	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 angles, 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)		
<b>2</b>	<b>Space Segment</b>		1,2,3	08
	2.1	Attitude control, spinning satellite stabilization, momentum wheel stabilization, station keeping, thermal control, TT and C subsystem, transponders, wideband receiver, input demultiplexer, power amplifier, antenna subsystem		
	2.2	Equipment reliability and space qualification		
<b>3</b>	<b>Satellite Links</b>		1,2	12
	3.1	Isotropic radiated power, transmission losses, free-space transmission, feeder losses, antenna misalignment losses, fixed		



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		atmospheric and ionospheric losses, link power budget		
	<b>3.2</b>	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		
	<b>3.3</b>	<b>Uplink:</b> Saturation flux density, input back off, earth station HPA, <b>Downlink:</b> Output back off, satellite TWTA output		
	<b>3.4</b>	Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, inter-modulation noise		
<b>4</b>	<b>Earth Station.</b>		1,3	04
	<b>4.1</b>	Design considerations, receive-only home TV systems, outdoor-indoor unit for analog (FM) TV, master antenna TV system, transmit-receive earth stations		
	<b>4.2</b>	Community antenna TV systems		
<b>5</b>	<b>The Space Segment Access and Utilization.</b>		1,3	08
	<b>5.1</b>	Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation		
	<b>5.2</b>	<b>TDMA:</b> 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		
	<b>5.3</b>	<b>Code Division Multiple Access:</b> Direct-sequence spread spectrum-acquisition and tracking, spectrum spreading and dispreading – CDMA throughput		
<b>6</b>	<b>Satellite Networking</b>		2,3	10
	<b>6.1</b>	<b>Satellite Network:</b> 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		
	<b>6.2</b>	<b>Laser Satellite Communication:</b> Link analysis, optical satellite link transmitter, optical satellite link receiver, satellite beam acquisition, tracking & positioning, deep space optical communication link		
			<b>Total</b>	<b>52</b>



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## 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