Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETC 802	Satellite Communication and Network	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETC 802	Satellite Communication and Network	20	20	20	80	-	-	-	100

Pre-requisites:

- ETC 502: Analog communication
- ETC 601: Digital Communication

Course Objective:

- To provide an in-depth understanding of different concepts used in a satellite communication system.
- To explain the tools necessary for the calculation of basic parameters in a satellite communication system.
- To get knowledge of every aspects of satellite communication like orbital mechanics, launching techniques, satellite link design, earth station technology and different access system towards a satellite.

Course Outcome: The Students will be able to

- Explain the basics of satellite communication
- Explain and analyzes link budget of satellite signal for proper communication
- Use the system for the benefit of society
- Use the different application of satellite communication

Module No.		Topics	Hrs.
1.		**Overview of Satellite Systems, Orbits and Launching**	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 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 Segment**	8
	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		**Satellite Links**	12
	3.1	Isotropic radiated power, transmission losses, free-space transmission, feeder losses, antenna misalignment losses, fixed atmospheric and ionospheric losses, link power budget	
	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, inter-modulation noise	
4		**Earth Station.**	04
	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	
5		**The Space Segment Access and Utilization**.	8
		Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, bandwidth-limited and power-limited TWT amplifier operation	
		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	
		Code Division Multiple Access: Direct-sequence spread spectrum–acquisition and trackling, spectrum spreading and dispreading – CDMA throughput	
6		**Satellite Networking**	10
	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	
	6.1	**Laser Satellite Communication:** Link analysis, optical satellite link transmitter, optical satellite link receiver, satellite beam acquisition, tracking & positioning, deep space optical communication link	
		Total	**52**

Recommended Books:

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
5. M. Richharia, "*Satellite Communication Systems Design Principles*", Macmillan Press Ltd. Second Edition 2003.
6. Gerard Maral, "*VSAT Networks*", John Willy & Sons

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining question will be selected from all the module