

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (COMMUNICATION SYSTEMS ENGG) (05)

SATELLITE COMMUNICATION

SUBJECT CODE: 2720506

M.E. SEM-II

Type of course: Major Elective III

Prerequisite: This course assumes that students have had an introduction to communication systems and the description of signals and circuits in terms of their frequency spectra and frequency response. A basic knowledge of analog and digital modulation is required, as is a working level familiarity with the basics of random variables and probability distributions.

Rationale: This course provides a comprehensive understanding of satellite communication principles and related technologies. Starting from orbital mechanics related to spacecraft deployment, the course evolves through satellite link design, signal processing, and access techniques.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	30	0	10	10	150

Sr. No.	Content	Total Hrs	% Weightage
1	SATELLITE ORBITS Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, GEO stationary and non GEO-stationary orbits, Look Angle Determination, Limits of visibility, Eclipse-Sub satellite point, Sun transit outage, Launching Procedures launch vehicles and propulsion.	6	14%
2	RADIO WAVE PROPAGATION Signal impairment: Rain attenuation, Atmospheric losses, Ionospheric effects, Polarization, Antenna radiation patterns, Antenna arrays	4	8%
3	SPACE SEGMENT AND SATELLITE LINK DESIGN Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation-performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.	10	24%

4	SATELLITE ACCESS Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption	8	20%
5	EARTH SEGMENT Earth Station Technology-- Terrestrial Interface, Transmitter and Receiver, Antenna Systems TVRO, MATV, CATV, Test Equipment Measurements on G/T, C/No, EIRP, Antenna Gain.	4	8%
6	SATELLITE APPLICATIONS INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- World space services, Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video Conferencing, Internet.	8	20%
7	CASE STUDIES DBS-TV, GPS, LEO and VSAT network	2	6%
	Total	42	100%

Reference Books:

1. Dennis Roddy, 'Satellite Communication', McGraw Hill International, 4th Edition, 2006.
2. Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnut, Wiley Student edition, second edition
3. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 2007.
4. A.K. Maini and V. Agrawal, Satellite Technology, John Wiley and Sons, 2007.
5. B. Elbert, Introduction to Satellite Communication, 3rd ed., Artech House, 2008.
6. Others: IEEE Transactions and other journals.

Course Outcome:

The course will cover every aspects of satellite communication like orbital mechanics, launching techniques, satellite link design, earth station technology and different access system towards a satellite.

Student will be able:

- To design satellite communication systems using both a creative and systematic approach applying concepts and principles developed to solve a particular engineering need.
- To analyze modulation and coding schemes in satellite communication systems using principles and techniques developed throughout the course.
- To design satellite communication systems using GEO or LEO satellites to carry voice, video, or data signals using analog or digital modulation.

List of Open Source Software/learning website:

1. International Journal of Satellite Communications and Networking Wiley Publications Online
ISSN: 1542-0981.
2. <http://spacejournal.ohio.edu/>
3. www.nptel.ac.in

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.