

SATELLITE COMMUNICATION

VI Semester: ECE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC522	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45		Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 45	
<p>OBJECTIVES: The course should enable the students to</p> <ol style="list-style-type: none"> I. Understand the communication space craft and orbits. II. Interpret the access systems in communication satellites. III. Understand the VSAT system technologies. IV. Interpret packet communications in satellite. <p>COURSE OUTCOMES (COs):</p> <p>CO: 1 Discuss the satellite subsystems, spacecraft and orbits</p> <p>CO: 2 Analyze the design of Satellite link budget and discuss the satellite subsystems like telemetry, tracking and command system.</p> <p>CO: 3 Discuss the significance of different types of multiple access techniques in communication satellites.</p> <p>CO: 4 Analyze the earth station technology and constellation of NGSO</p> <p>CO: 5 Evaluate the future satellite communication systems and error control coding for digital satellite links</p> <p>COURSE LEARNING OUTCOMES (CLOs):</p> <ol style="list-style-type: none"> 1. Discuss the different satellite systems like Low earth orbit (LEO), Medium earth orbit (MEO) and Geo synchronous earth orbit (GEO). 2. Understand how the satellite is locating with respect to earth and orbital perturbations due to earth's oblateness, moon and sun. 3. Understand the satellite sub systems like Telemetry, tracking and command system, power system, satellite antenna equipment, communications subsystem and transponders. 4. Analyze the design of satellite links for a specified C/N with and without frequency Re-use and link budget. 5. Discuss the propagation effects like atmospheric absorption, cloud attenuation, troposphere and ionospeheric scintillation and low angle fading. 6. Discuss the effects of rain, rain induced attenuation, rain induced cross polarization and interference. 7. Analyze the various multiple access techniques used in communication satellites like FDMA, TDMA and CDMA. 8. Analyze the concept of demand assignment multiple access (DAMA), types of demand assignment and characteristics. 9. Understand the significance of Spread Spectrum Multiple Access (SSMA), Direct sequence CDMA (DS-CDMA) or DS spread spectrum transmission and reception. 10. Understand and analyze the Earth Station technology transmitters, receivers, antennas, tracking systems, terrestrial interface, power test methods and lower orbit considerations. 11. Analyze the Very Small Aperture Terminal (VSAT) network architecture, access control and multiple access selection. 								

<p>12. Analyze the constellation design of Non Geostationary Orbit (NGSO) coverage, frequency bands, delay and throughput.</p> <p>13. Understand the message transmission by FDMA using M/G/1 queue and message transmission by TDMA using pure aloha.</p> <p>14. Apply the error control coding for digital satellite links like block codes and convolution codes.</p> <p>15. Evaluate the future satellite communication systems and introduction to satellite laser communication.</p> <p>16. Apply the concept of satellite communication to understand and analyze real time applications.</p> <p>17. Acquire the knowledge and develop capability to succeed national and international level competitive examinations.</p>		
Unit-I	COMMUNICATIONS SPACECRAFT AND ORBITS	Classes: 10
<p>Overview of present and future trends of satellite communications introduction to satellite systems: Low earth orbit (LEO); Medium earth orbit (MEO); Geo synchronous earth orbit (GEO); Geostationary earth orbit (GEO); Orbital mechanics: Orbital elements; Locating the satellite with respect to the earth; Coverage angle; Slant range; Inclined orbits; Orbital perturbations due to earth's oblateness and moon and sun; Eclipse of GEO satellite; Sun transit outage.</p>		
Unit -II	SPACE SEGMENT	Classes: 09
<p>Placement of a communication satellite in GEO satellite sub systems: Telemetry, tracking and command system, power system, satellite antenna equipment, communications subsystem and transponders, TWT amplifier operation, satellite frequency bands and allocations; Satellite link: Basic transmission theory, system noise temperature and G/T ratio, basic link analysis, design of satellite links for a specified C/N with and without frequency Re-use , link budget; Propagation effects: Introduction, atmospheric absorption, cloud attenuation, troposphere and ionospheric scintillation and low angle fading; Effects of rain: Rain induced attenuation, rain induced cross polarization interference.</p>		
Unit -III	COMMUNICATION SATELLITE ACCESS SYSTEMS	Classes: 08
<p>Multiple Access: Frequency division multiple access (FDMA), Time division multiple access (TDMA), frame structure, burst structure, satellite switched TDMA, on-board processing, demand assignment multiple access (DAMA), types of demand assignment, characteristics. Code Division Multiple Access (CDMA) / Spread Spectrum Multiple Access (SSMA); Direct sequence CDMA (DS-CDMA) or DS spread spectrum transmission and reception, adjacent channel interference, inter modulation, handover, satellite diversity.</p>		
Unit -IV	EARTH STATION AND VSAT SYSTEMS TECHNOLOGY	Classes: 08
<p>Earth Station: Transmitters, receivers, antennas, tracking systems, terrestrial interface, power test methods, lower orbit considerations; VSAT (Very Small Aperture Terminal) Systems: Overview of VSAT systems, VSAT network architecture, access control, and multiple access selection. NGSO constellation design: Orbits, coverage, frequency bands, delay and throughput, non geostationary orbit (NGSO) constellation design and problems.</p>		
Unit -V	SATELLITE PACKET COMMUNICATION	Classes: 10
<p>Message transmission by FDMA: M/G/1 queue, message transmission by TDMA, pure aloha, satellite packet switching, slotted aloha, packet reservation, tree algorithm; Error control for digital satellite links: Error control coding, block codes, convolution codes, implementation of error detection on satellite links. Overview of future satellite communication systems, introduction to satellite laser communication, data relay communication satellites, satellite mobile services, applications.</p>		

Text Books:

1. Dennis rodgy, —Satellite Communications, 4th Edition, 2004.
2. Pratt. Bostian, Allnutt, —Satellite Communications, Wiley India, 2nd Edition, 2006.
3. Gérard Maral, —Satellite Communication Systems, 1993.
4. Tri T. Ha, Digital Satellite Communications 2nd edition, TMH, 1990.

Reference Books:

1. Rappaport T.S., —Wireless communications, 2nd Edition, Pearson Education, 2010
2. Bruce Elbert, —Introduction to Satellite Communications, 1987.
3. M Richharia, Satellite Communication Systems 2nd edition, MacMillan, 2005.

Web References:

1. <http://nptel.ac.in/courses/106105082/33>
2. http://onlinecourses.nptel.ac.in/noc16_ec10/preview

E-Text Books:

1. https://books.google.co.in/books/about/Satellite_Communications.html?id=yYP7hXJI7k4C
2. https://books.google.co.in/books/about/Satellite_Communication.html?id=Cw0MfJPIPs4C