FUTURE UNIVERSITY IN EGYPT جامعة المستقبل

Faculty of Engineering & Technology

Satellite Communication Systems

Information :

Course Code :	COM 524	**Level :**	Undergraduate	**Course Hours :**	3.00- Hours

Department : Specialization of Electronics & Communication

Instructor Information :

Title	Name	Office hours
Lecturer	Hisham Mohamed Qarni Dahshan	2
Assistant Lecturer	Ahmed Essam Fahim Zahran	4

Area Of Study :

1- Develop students' knowledge of Orbital Parameters and Terms and how to perform orbital corrections.
2- Enrich student knowledge about the Space dynamics and Orbitography.
3- Increase Student Skills in the design of The satellite communications links.
4- Increase the student technological information about the satellite subsystems.
5- Develop students' knowledge of the different Satellite services.

Description :

Satellite Orbits. Orbital Parameters and terms. General satellite orbit. LEOs , MEOs, GEO Satellite orbits. Keplerian set of orbital parameters. Orbit perturbations. Sun synchronous orbits. Geostationary orbit. Characteristics of Satellite communication. Uplinks ,Downlinks and onboard system. Power Budget calculations. Satellite EIRP , G/T ratio. Carrier To Noise ratio (C/N), Carrier To Noise Spectral Density ratio , Useful bitrate. Satellite Construction. Satellite subsystems: Payload (P/L), Electrical Power (EPS), Telemetry and Telecommand (TCR), Attitude Determination and Control (ADCS) subsystems. Construction of the P/L subsystem. Input Demultiplexer (IMUX) , Transponder , Travelling Wave Tube (TWT) as HPA, Channel Amplifiers (CAMPS), Output Multiplexer (OMUX). (P/L) receiving and transmitting antennas. Gregorian , Cassegrain and Parabolic Reflector antennas. Multiple access techniques. Methods of transmissions. MCPC and SCPC transmissions. Tradeoff between Bandwidth and Bitrate. Satellite Control Ground stations. Functions of the control stations. Frequency and Time , Baseband , and RF subsystems. Satellite Station Keeping Maneuvers.

Course outcomes :

a.Knowledge and Understanding: :

1 -	a1. Estimate the fundamental satellite orbital terms and parameters.
2 -	a2. Define the main functions and constructions of the satellite subsystems: P/L, ADCS, EPS, TCR.
3 -	a3. Classify between the different Time standards and calendars.
4 -	a4. Relate any of the following coordinate system to another: Perifocal Coordinate System. Topocentric Coordinate Systemï Geocentric Inertial Coordinate System.
5 -	a5. Estimate of the Power Budgets, for the Uplink and Downlink channels and Power-Bandwidth Trade-off.
6 -	a6. Classify between the SCPC and MCPC methods of transmission.

7 -	a7. Explain the construction and functions of the ground control stations (GCS).
b.Intellectual Skills: :	
1 -	b1. Apply the different techniques to the power budget calculations.
2 -	b2. Analyze the obtained results both individually or as a part of a team.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Introduction to satellite systems. Satellite services, frequency allocation	5	3	2
Satellite orbits. Kepler's laws. Orbital terms and parameters. Keplerian set.	10	6	4
Orbital perturbations. Effect of non-spherical Earth shape. Regression of nodes. Rotation of apsides. Atmospheric drag	10	6	4
Calendars & Times. UTC , GMT , Julian Date. LEO, MEO, GEO orbits. Mid-Term Exam 1.	10	6	4
Tracking angles and arc of visibility. Coordinate systems. (IJK) , (PQW) , (SEZ) frames	10	6	4
Sub-satellite subsystems: P/L ,EPS ,TCR,ADCS. Power Budget , C/N, C/No Ratios. SFD of a link. MCPC and SCPC transmission +Mid-Term Exam 2	20	12	8
Antenna Systems. Parabolic , Cassegrain, and Gregorian syst. GCS stations. Bandwidth- Bitrate trade-off. FEC and RS Coding. QPSK modulation.	10	6	4

Teaching And Learning Methodologies :

- Interactive Lecturing
- Discussion
- Problem Solving

Recommended books :

"Satellite Communication Systems ", G.Maral & M.Bousquet , 3rd edition, John Wiley & Sons, 2001.