Hijjawi faculty for Engineering Technology
Communications Engineering Department

CME-574
Satellite Communications
Syllabus
2nd Semester 2006/2007

Course Coordinator

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Catalog Data

Engineering and commercial aspects, orbital mechanics, look angles determination, orbital effects in system performance, spacecraft subsystems, transponders, antennas, satellite link design, modulation and multiplexing techniques used in satellite communication systems, multiple access (FDMA, TDMA, CDMA)

Course Objectives

- This is a required course for students at a senior year.
- The goal of the course is to introduce students to the fundamentals of satellite communication.
- To provide them with a sound understanding of how a satellite communication system successfully transfers information from one earth station to another.
- To expose them to examples of applications and tradeoffs that typically occur in engineering system design, and to ask them to apply the knowledge in design problems.
- This course contributes to the educational objectives 1(Fundamental knowledge), 2 (Specialization),3 (design skills) and 4 (self-learning).

Textbook

T. pratt, Ch. Bostain, J.Allnutt, Satellite Communications, 2nd edition, John Wiley & Sons, 1986

References

Book Refrences

- D. Roddy, Satellite Communications, 3rd ed., McGraw-Hill, 2001.
- B. Elbert, Introduction to Satellite Communications, 2nd ed., Artech House, 1999.
- G.Maral, M. Bousquet, Satellite Communications systems, 2nd edition, John Wiley & Sons, 2002.

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Web References:

- MIT OPENCOURSEWARE:
- Instructor website: www.just.edu.jo/~hazem-ot

Prerequisite by Course and Topic

- CME 452-Digital communications

Course Outcomes and Related Program Outcomes

1. How to describe the motion of satellite in the orbit.
2. How to compute look angles: Elevation and azimuth. (a c e f k)
3. How to compute the coverage angle and angle of visibility and consequently determine the coverage area. (a c e f k)
4. How to relate the coverage area with the beam width of satellite antenna. (a m n)
5. Understand orbital effects in communications system performance. (a b c e i)
6. To study transponders and earth stations.
7. How to calculate the received carrier power at the input of earth station receiver or satellite transponder. (a b c e i)
8. How to compute the noise power. (a c e f k)
9. How to calculate the carrier to noise ratio at the input of earth station or satellite transponder. (a b c e h)
10. How to design both up-link and down link. (a b c e h k)
11. How to design low-capacity satellite links such as maritime systems. (a b c e h k)
12. How to design domestic satellite system using small earth station. (a b c e h k)
13. How to calculate noise power budget. (a b c e k)
14. How to calculate the performance of analog systems and digital systems (SNR and BER). (a b c e k)
15. To study and to understand the concept of technology: FDMA,TDMA, CDMA. (a b c e i)
16. Opportunity to conduct a MATLAB-based design project requiring some independent reading, programming, simulation. (b c g)

Course Topics

- Orbital aspects of satellite communication and spacecraft subsystems: orbital mechanics, look angle determination, orbital effects in communications system performance, spacecraft subsystems. (18 hours)
- Satellite link design: basic transmission theory, down-link design, up-link design, noise power budget, design applications (INMARSAT, DBS TV). (10 hours)
- Modulation and multiplexing techniques for satellite links: Analog telephone transmission and multiplexing, analog TV transmission SNR calculations, Digital transmission and reception, TDM, BER & SER calculations. (10 hours)
- Multiple access: FDMA, TDMA, CDMA. (6 hours)

Tests, Projects and Grading Policy

Grading Component	Points	Due Date
Test #1	20%	28.10.2007
Test #2	20%	16.12.2007
Projects/Home works/Quizzes	10%	To be announced by the instructor
Final Exam	50%	To be announced by the deanship office
TOTAL	**100%**	

Class/Laboratory Schedule

- Two 50-minute lectures/discussion sessions per week.

Contribution of Course to Meeting the Professional Component

- Engineering Topics: 80%
- Mathematics and Basic Science: 20%
- General Education: 0%

A communications satellite is an artificial satellite that relays and amplifies radio telecommunications signals via a transponder; it creates a communication channel between a source transmitter and a receiver at different locations on Earth. Communications satellites are used for television, telephone, radio, internet, and military applications. There are about 2,000 communications satellites in Earth's orbit, used by both private and government organizations. Many are in geostationary orbit 22,236