**King Fahd University of Petroleum & Minerals**

Electrical Engineering Department

**EE 418: Introduction to Satellite Communications (3–0–3)**

First Semester 121 (2012), Version 1.2

**Instructor:** Dr. Ali Hussein Muqaibel

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**Office Hours:** S.M.W 10:00-10:50, or by appointment. Check website for updated office hours

**Course Topics:** Overview of satellite systems. Orbits and launching methods. Communication satellite subsystems. Modulation schemes and satellite multiple access (FDMA, TDMA, CDMA, and SDMA). Space link analysis. Satellite antennas. Applications and satellites.

**Prerequisites:** EE 340 and EE 370

**Textbook:** T. Pratt, C. Bostian, and J. Allnutt, *Satellite Communications,* 2nd edition, John Wiley & Sons, 2003.

**Course Outcomes:** Upon successful completion of this course, you should be able to

1. Apply knowledge of mathematics, science and engineering to determine location of a satellite in its orbit and to calculate the link budget.

2. Identify, formulate, and solve engineering problems related to the design of satellite systems.

3. Use programming techniques and tools to calculate satellite coordinates and look angles.

4. Function on teams through project work identifying current problems and methods for remedy.

5. Learn about the current trends in satellite communication systems.

**Mark Distribution:**

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| **item** | **%** | **Notes** |
| Attendance | **3** |  |
| HW + Computer Assignments | **15** |  |
| Quizzes | **12** |  |
| Term Paper | **5** |  |
| Exam 1 | **15** | Monday, Week 6 |
| Exam 2 | **20** | Monday, Week 12 |
| Final Exam | **30** | Scheduled by Registrar |

**Additional Notes:**

**Note #1:** Final Exam is comprehensive (i.e. covers all chapters as described in the syllabus).

**Note #2:** According to the rules and regulations of KFUPM, attendance is **MANDATORY**. More than **8** unexcused absences will be reported to the registrar office and result in a **GRADE of DN** regardless of the student’s grade. Every unexcused absence results in -1/3. 9 absences results in 0 out of 3 in the attendance and class performance, Two late arrival= One absence.

**Note #3:** You can access the supplement material, communication items, and any ***course information*** at your instructor’s Webpage or WebCT course page.

**Course Breakdown**

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| --- | --- | --- | --- | --- |
| **Week** | **Dates** | **Topics** | **Book Chapters** | **Notes** |
| 1 | 1 Sep. | Introduction, background, basic satellite systems, applications and future trends. | 1 |  |
| 2 | 8 Sep. | Satellite orbits, Kepler's and Newton's laws of satellite motion, coordinate systems, orbital parameters, satellite path in space | 2.1 |  |
| 3 | 15 Sep. | Look angle determinations  Orbital Perturbation (Reading)  Orbital Effects in Communication Systems Performance | 2.2  2.3  2.6 |  |
| 4 | 22 Sep. | Geostationary satellites, launching of geostationary satellites, frequency & propagation considerations, ITU regulations, tropospheric and ionospheric effects. | 3 | (Exclude 3.2) |
| 5 | 29 Sep. | Communication link design, antenna basics, transmission formula. | 4.1-4.3 |  |
| 6 | 6 Oct. | Noise, thermal noise, noise figure and temperature, antenna noise temperature and system noise temperature, interference | 4.4 |  |
| **Major Exam I, Monday 8th Oct. @ 6:30 pm – 8:30 pm** | | | | |
| 7 | 13 Oct. | Link design considerations, up– and down–links, examples of link design. | 4.5-4.8 | Exclude Example 4.8.2 |
| ***Eid Al Adha Vacation 18 Oct. -2 Nov.*** | | | | |
| 8 | 3 Nov. | Modulation, system considerations, linear schemes, FM, Digital modulation schemes. | 5.1-5.2 |  |
| 9 | 10 Nov. | Digital Transmission, Bandlimited channels, baseband and band-pass transmission | 5.3 |  |
| 10 | 17 Nov. | Digital Transmission, voice , TV, Time Division Multiplexing. | 5.4-5.6 |  |
| 11 | 24 Nov. | CDMA | 6.8 |  |
| **Major Exam II, Monday, 3th Dec. @ 6:30 pm – 8:30 pm** | | | | |
| 12 | 1 Dec. | Error Detection and Correction, Channel Capacity, Liner and cyclic block codes, Golay Codes | 7.1-7.3 |  |
| 13 | 8 Dec. | Performance of Block error correcting codes, convolutional codes, Implementation of Error Detection in satellite links (ARQ), Concatenated Coding and interleaving | 7.4-7.9 |  |
| 14 | 15 Dec. | Propagation Effects  New technologies related to satellite Communications | 8.3  Student Present |  |
| 15 | 22 Dec. | Future trends and applications. | 11 |  |
|  |  | Review |  |  |
| ***Final Exams*** | | | | |