COURSE OUTLINE

ELEC 405 – Satellite Communications

Prepared By: Stephen E. Frempong
A. **TITLE**: Satellite Communications

B. **COURSE NUMBER**: ELEC 405

C. **CREDIT HOURS**: 3

D. **WRITING INTENSIVE COURSE**: NO

E. **WEEKS PER SEMESTER**: 15

F. **SEMESTER OFFERED**: SPRING/FALL

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY**: 3 hours lecture per week

H. **CATALOG DESCRIPTION**: This course will emphasize on hardware and the basic operating techniques of every major supporting subsystem, the reliability analysis that allow satellites to operate for years without maintenance. Topics include: Propulsion, Structure, Thermal control, Reliability, Spacecraft testing, Spacecraft attitude, System performance, Telemetry, Tracking, and Command.

I. **PRE-REQUISITES/CO-COURSES**: ELEC 385 [Electronic Communications I] or permission of instructor.

J. **GOALS (STUDENT LEARNING OUTCOMES)**

   **Institutional Student Learning Objectives (SLO)**

   (1) Communication (2) Critical Thinking (3) Professional Competence

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<tr>
<th>Course Objectives / ABET (SLO)</th>
<th>Institutional SLO</th>
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<tr>
<td>An ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies.</td>
<td>3. Professional Competence</td>
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<td></td>
<td>2. Critical Thinking</td>
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<td>An ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.</td>
<td>1. Communications</td>
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<td>A commitment to quality, timeliness, and continuous improvement.</td>
<td>3. Professional Competence</td>
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L. REFERENCES:

M. EQUIPMENT: None

N. GRADING METHOD: A-F


P. DETAILED TOPICAL OUTLINE:

1. Overview of Satellite Systems
   a. Introduction
   b. Frequency Allocations for Satellite Services
   c. Intelsat
   d. U.S. Domsats
   e. Polar Orbiting Satellites
2. Orbits and Launching Methods
   a. Kepler’s First/Second Laws
   b. Apogee and Perigee Heights
   c. Orbital Elements
   d. Inclined Orbits
3. The Geostationary Orbit
   a. Antenna Look Angles
   b. The Polar Mount Antenna
   c. Near Geostationary Orbits
   d. Earth Eclipse of Satellite
   e. Launching Orbits
4. The Space Segment
   a. The Power Supply
   b. Attitude Control
   c. Station Keeping
   d. Thermal Control
   e. Transponders
   f. The Antenna Subsystem
5. The Space Link
   a. Equivalent Isotropic Radiated Power
   b. Transmission Losses
   c. The Link Power Budget Equation
   d. System Noise
   e. Carrier-to-Noise Ratio
   f. The Uplink
   g. Downlink
h. Effects of Rain
i. Intermodulation Noise

6. Satellite Services and the Internet
   a. Network Layers
   b. The TCP Link
   c. Satellite Links and TCP
   d. Asymmetric Channels

7. Direct Broadcast Satellite Services
   a. Orbital Spacing
   b. Power Rating and Number of Transponders
   c. Frequencies and Polarization
   d. Transponder Capacity
   e. Uplink/Downlink Analysis
   f. Standing Wave Ratio

8. Satellite Services
   a. Satellite Mobile Services
   b. VSATs
   c. Radarsat
   d. Global Positioning Satellite System
   e. Obcomm