SPH 432 – Satellite and Mobile Communication Systems
4th YEAR COURSE

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URL:
Syllabus

PART I: Satellite

• General requirements of satellite communication; Digital communication for satellite systems;
• Geometrical consideration of geo-stationary satellites; Orbits; Earth-satellite distance; Station antenna; Pointing angles; Earth coverage;
• Earth station technology: transmitters, receivers; Antenna system; Satellite repeater station technology; Altitude and orbit sub-system; Telemetry; Tracking and command; Electric power supply;
• Launching and positioning of a geo-stationary satellite;
• Payload;
• Calculations of velocity increment; Orbit inclination correction; Characteristics of thrusters and launch vehicles; Station keeping for inclination correction;
• Astronomical consideration on movement of satellite;
• Digital communication systems used from space to ground via satellite;

PART II: Mobile Communication Systems

• Elements of cellular radio system design; Specifications of analogue systems;
• Cell coverage for signal and traffic;
• Cell-site antennas; Mobile antennas;
• Co-channel interference reduction; Types of non-channel interference;
• Frequency management and channel assignment;
• Handoffs and dropped calls;
• Operational techniques and technologies;
• Switching; Data links; Microwave links;
• System evaluation;
• Digital cellular systems;
• Intelligent call concept and applications; Intelligent network for wireless communication
<table>
<thead>
<tr>
<th>Topics</th>
<th>Outline</th>
<th>Contact Hours</th>
<th>Dates</th>
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<tbody>
<tr>
<td><strong>Lesson 1: Introduction</strong></td>
<td>What is a satellite?</td>
<td>2 hrs</td>
<td>13&lt;sup&gt;th&lt;/sup&gt; Jan 2015</td>
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<tr>
<td></td>
<td>What is an orbit?</td>
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<tr>
<td></td>
<td>❖ Kepler’s Laws of Planetary Motion</td>
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<td>❖ The Six Keplerian Elements</td>
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<td></td>
<td>❖ Geometrical consideration of geo-stationary satellites</td>
<td>1hr</td>
<td>19&lt;sup&gt;th&lt;/sup&gt; Jan 2015</td>
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<td><strong>Lesson 2: Satellite or space segment</strong></td>
<td>payload</td>
<td>2 hrs</td>
<td>20&lt;sup&gt;th&lt;/sup&gt; Jan 2015</td>
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<tr>
<td></td>
<td>spacecraft subsystems</td>
<td>1 hr</td>
<td>26&lt;sup&gt;th&lt;/sup&gt; Jan 2015</td>
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<tr>
<td><strong>Lesson 3: Launch system</strong></td>
<td>Launch vehicle or Launch site</td>
<td>2 hrs</td>
<td>27&lt;sup&gt;th&lt;/sup&gt; Jan 2015</td>
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<tr>
<td></td>
<td>launcher</td>
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<td>LEOP- Launch and Early Orbit Phase</td>
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<td>❖ Sequence of Events (SOE): Launching, parking, transfer, final or operational stage</td>
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<td><strong>Tutorial 1</strong></td>
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<td>1 hr</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Feb 2015</td>
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<tr>
<td><strong>Lesson 4: Ground segment</strong></td>
<td>Earth station technology: Antenna system; transmitters, receivers;</td>
<td>2 hrs</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Feb 2015</td>
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<td>Satellite repeater station technology;</td>
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<td>Telemetry; Tracking and command;</td>
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<td>Flight dynamic</td>
<td>1 hr</td>
<td>9&lt;sup&gt;th&lt;/sup&gt; Feb 2015</td>
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<td><strong>Lesson 5: Elements of cellular radio system design;</strong></td>
<td>Specifications of analogue systems; Cell coverage for signal and traffic; Cell-site antennas; Mobile antennas; Co-channel interference reduction; Types of non-channel interference; Frequency management and channel assignment;</td>
<td>2 hrs</td>
<td>10&lt;sup&gt;th&lt;/sup&gt; Feb 2015</td>
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<td><strong>Lesson 6: Handoffs and dropped calls;</strong></td>
<td>Handoffs and dropped calls;</td>
<td>1 hr</td>
<td>16&lt;sup&gt;th&lt;/sup&gt; Feb 2015</td>
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Lesson 7: Operational techniques and technologies; Switching; Data links; Microwave links; System evaluation; 1hr 23rd Feb 2015

Lesson 8: Digital cellular systems; Digital cellular systems; 2hrs 24th Feb 2015

Lesson 9: Intelligent call concept and applications; Intelligent call concept and applications; 1hr 2nd March 2015

Lesson 10: Intelligent network for wireless communication Intelligent network for wireless communication 2hrs 3rd March 2015

Tutorial 2 1 hr 24th Mar 2015

Note: All classes will be held in Room 230A On Mon : 8-9am and Tue. 8-10am

1. Textbook and References
   - Space systems Engineering Third Edition by Peter Fortescue, John Stark and Graham Swinerd
   - Space mission Analysis Third Edition by James R wetz and Willy J Larson
   - Satellite Communication 2nd Ed. By Timothy Pratt, Charles Bostian and Jeremy Allnutt

2. Grading Rule

   Evaluations will be based on two continuous assessment tests (CAT), three tutorials, homework assignment, the class project, and a final exam. The tables below provide the weight distribution of each category with details on the project evaluation, and the scale for final grade assignment.

<table>
<thead>
<tr>
<th>Grading Categories</th>
<th>CAT 1</th>
<th>CAT 2</th>
<th>TUTORIALS</th>
<th>EXAM</th>
<th>PTOTAL</th>
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<td>B</td>
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<td>70-100</td>
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