

Subject Description Form

Subject Code	EIE509
Subject Title	Satellite Communications – Technology and Applications
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	The students are expected to have some basic knowledge about digital communication systems. Extra materials will be provided for self-learning before the commencement of the course on request for those who do not have the appropriate knowledge. Please contact the subject lecturer for details.
Objectives	This subject will introduce students with the conventional and advanced technologies used in satellite communication systems. The students will study the design parameters of the transceiver on the performance of the link quality. Various multiple access techniques and resource allocation strategies will be compared to point out their relative merits and demerits. The multibeam and regenerative satellites networks, which render the use of small size earth station terminals possible, will also be discussed. Examples on global mobile satellite services will be given.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (1) Professional/academic knowledge and skills a. Understand and describe the basic theories and principles in satellite communication systems. b. Analyze, design, and evaluate satellite communication systems. (2) Attributes for all-roundedness c. Communicate effectively. d. Think critically and creatively. e. Assimilate new technological development in related field.
Subject Synopsis/ Indicative Syllabus	1. Introduction Historical background of satellite technology development; organisation of a satellite communication system. 2. Orbits Overview of orbits; orbit dynamics and Kepler's laws; relative movement of two point bodies; orbital parameters; Earth-satellite geometry. 3. Link Analysis Basic satellite link analysis; effect of rain on link performance. 4. Multiple Access Traffic routing; frequency division multiple access; time division multiple access; code division multiple access; fixed and on-demand assignment. 5. Multibeam Satellite Networks Advantages and disadvantages; transponder hopping; on-board switching; beam scanning; intersatellite links. 6. Regenerative Satellite Networks Transparent and regenerative repeaters; comparison of link budgets; on-board processing; effect on Earth stations. 7. Global Mobile Satellite Services GEO mobile satellite systems, Inmarsat.

Teaching/Learning Methodology	<p>The theories and applications of satellite communication systems will be described and explained in lectures. Techniques and parameters for evaluating satellite communication systems will be presented in tutorials. A site visit to a satellite earth station will further provide an opportunity for students to understand the various components of a commercial satellite communication system as well as the operations of the ground unit. Students will also be requested to study in detail some selected satellite communication or space exploration systems, share their findings with other classmates through two presentations and write a report summarizing their findings.</p>																																														
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	Tutorials	✓	✓		✓																																										
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Assessment Methods in Alignment with Intended Learning Outcomes	<table border="1"> <thead> <tr> <th data-bbox="419 663 754 779">Specific assessment methods/tasks</th> <th data-bbox="754 663 914 779">% weighting</th> <th colspan="5" data-bbox="914 663 1461 745">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <td data-bbox="419 779 754 846">1. Assignments/</td> <td data-bbox="754 779 914 846">25%</td> <td data-bbox="914 779 1018 846">✓</td> <td data-bbox="1018 779 1121 846">✓</td> <td data-bbox="1121 779 1225 846">✓</td> <td data-bbox="1225 779 1329 846">✓</td> <td data-bbox="1329 779 1461 846"></td> </tr> <tr> <td data-bbox="419 846 754 913">2. Tests</td> <td data-bbox="754 846 914 913">20%</td> <td data-bbox="914 846 1018 913">✓</td> <td data-bbox="1018 846 1121 913">✓</td> <td data-bbox="1121 846 1225 913">✓</td> <td data-bbox="1225 846 1329 913">✓</td> <td data-bbox="1329 846 1461 913"></td> </tr> <tr> <td data-bbox="419 913 754 981">3. Mini-project</td> <td data-bbox="754 913 914 981">55%</td> <td data-bbox="914 913 1018 981"></td> <td data-bbox="1018 913 1121 981"></td> <td data-bbox="1121 913 1225 981">✓</td> <td data-bbox="1225 913 1329 981"></td> <td data-bbox="1329 913 1461 981">✓</td> </tr> <tr> <td data-bbox="419 981 754 1055">Total</td> <td data-bbox="754 981 914 1055">100%</td> <td colspan="5" data-bbox="914 981 1461 1055"></td> </tr> </thead></table>					Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					1. Assignments/	25%	✓	✓	✓	✓		2. Tests	20%	✓	✓	✓	✓		3. Mini-project	55%			✓		✓	Total	100%												
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	<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Assignments and tests let students review the taught materials, do further reading for deeper learning and apply the learnt materials to solving common satellite communication system problems</p> <p>Mini-project requires the student to do further reading, search for information, keep abreast of current development, give presentations and write a report</p>																																														
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Reading List and References	<p><u>Text book:</u></p> <ol style="list-style-type: none"> <li data-bbox="419 1883 1461 1951">1. G. Maral, M. Bousquet and Zhili Sun, <i>Satellite Communications Systems</i>, 6th ed., John Wiley, 2020. <p><u>Reference books:</u></p> <ol style="list-style-type: none"> <li data-bbox="419 2007 1461 2051">1. Dennis Roddy, <i>Satellite Communications</i>, 4th ed., McGraw-Hill, 2006. <li data-bbox="419 2051 1461 2096">2. A.K. Maini and V. Agrawal, <i>Satellite Technology</i>, John Wiley and Sons, 2007. <li data-bbox="419 2096 1461 2130">3. B. Elbert, <i>Introduction to Satellite Communication</i>, 3rd ed., Artech House, 2008. 																																														

	<ol style="list-style-type: none">4. Daniel Minoli, <i>Innovations in Satellite Communications and Satellite Technology</i>, Wiley, 2015.5. Louis J. Ippolito, <i>Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance</i>, 2nd ed., Wiley, 2017. <p><u>Others:</u></p> <ol style="list-style-type: none">1. <i>IEEE Transactions</i> and other journals.
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July 2022