The Hong Kong Polytechnic University

Subject Description Form

Subject Code	LGT2xxx
Subject Title	Introduction to Space Commerce
Credit Value	3
Level	3
Normal Duration	1-semester
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This is an introductory course, designed for students to understand the emerging dynamics and ecosystem of space infrastructures & interplanetary logistics. Students will develop necessary skills and knowledge for analysing this new emerging global industry, providing a foundation for advanced level courses in these subjects.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Understand the space infrastructure ecosystem and intricate relationships between satellites, antennas, command centres, space stations, spaceports, manufacturing facilities, logistics, ground networks and other related facilities and support operations. (b) Evaluate the suitability of different types of Space Launch System (SLS) for specific cargo, passenger, and services requirements, by applying basic concepts. (c) Be familiar with current developments in the commercial interplanetary space industry. (d) To create a personal gateway for students' future research proposals in space development and potentially work in the commercial/national space industry. The subject content includes a range of information on space infrastructure/ logistics in the commercial and military sector, with general financing and economics and emerging Space Law. The students are required to read materials and understand basic research in the area. Students will be given basic case studies on Space Projects organized by NASA, SpaceX and other organizations.
Subject Synopsis/ Indicative Syllabus	**Introduction** Overview of the space ecosystem and intricate relationships between satellites, antennas, command centres, space stations, spaceports, manufacturing facilities, logistics, ground networks and other related facilities and support operations. ▪ Discussion on the characteristics (structure, delivery systems, components) of essential Space Infrastructures. ▪ Study of distinctive Space Logistic Projects and emphasize on the importance of supply-chain in the future development projects such as missions to Mars, LEO, Moon or to ISS (International Space Station). ▪ Study the development of an integrated capability for an interplanetary supply chain to enable sustainable space exploration of the Earth-Moon-

Mars system and beyond.

Major National and Commercial Space Projects
Discussion and in-depth review of major Space Projects (such as Apollo 11, Falcon 9 and many more) from several perspectives such as:

- Supply Chain
- Logistics
- Safety
- Product development
- Quality management

Perspectives in Space Logistics

- Discussion on the major safety concerns – associated with Space logistics and technologies
- Introduction to future national and commercial Space Infrastructure Projects
- Discussion on the regulations and current issues in connection with Space Logistics and Infrastructure.

Teaching/Learning Methodology

Lectures introduce and explain key concepts with appropriate examples.

Tutorials give students an opportunity to enhance their understanding of concepts taught in lectures. Tutorials are highly interactive and include discussions of current / past events, case studies and may include student presentations.

Presentations and reports will be a major part of this subject, and students are expected to be active in participation during classes.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d		
Individual Project	40%	✓	✓	✓	✓		
Class Participation	10%	✓	✓	✓	✓		
Final Examination	50%	✓	✓	✓	✓		
Total	100 %						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The **40% weighting** for the individual project that is collaborative in nature, will induce students learn project management skills, how to share tasks, engage with each other, and benefit from listening to others' viewpoints and backgrounds.

The **10% weighting** for class participation by proactively offering ideas and/or asks questions is especially important for the personal development of the student's self-esteem and confidence as a potential leader.

The **50% weighting** for the final examination is important to ensure that my students have retained all the information learned throughout the semester and provides an efficient way to measure each student's knowledge and how much they have learned.

Student Study Effort Expected	Class contact:	
	▪ Lectures	26 Hrs.
	▪ Tutorials	13 Hrs.
	Other student study effort:	
	▪ Self-study	31 Hrs.
	▪ Individual project	60 Hrs.
	Total student study effort	130 Hrs.

Reading List and References

Compulsory

1. Ferretti, S. (Ed.). (2020). *Space Capacity Building in the XXI Century* (Vol. 22). Springer Nature. (428 pages)
2. PwC (2020, December 11). *Main Trends & Challenges in the Space Sector*. PwC France Space Practice, pp.1-48. (48 pages)
3. Wooten, J. O., & Tang, C. S. (2018). *Operations in space: Exploring a new industry. Decision Sciences*, 49(6), 999-1023 (25 pages)
4. Galluzzi, M., Zapata, E., de Weck, O., & Steele, M. (2006). *Foundations of supply chain management for space application*. In Space 2006 (p. 7234). (17 pages)
5. Jones, R. (2007). *Near-term manned space logistics operations. Air & Space Power Journal*, 21(1). (25 pages)

Supplementary

1. Matt Weinzierl & Mehak Sarang (2021). *The Commercial Space Age Is Here*. Retrieved from http://https://hbr.org/2021/02/the-commercial-space-age-is-here
2. McKinsey Reports & (2017). *Perspectives on the future of space exploration.* Retrieved from https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/perspectives-on-the-future-of-space-exploration
3. Chris Daehnick (2021). *Large LEO satellite constellations: Will it be different this time? In McKinsey Journal*. Retrieved from https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/large-leo-satellite-constellations-will-it-be-different-this-time
4. United Nations Office of Outer Space Affairs (2021). *SPACE ECONOMY Initiative*. Retrieved from https://www.unoosa.org/documents/pdf/Space%20Economy/Space_E
5. Bruce Cahan & Mir Sadat (2020). *US Space Policies for the New Space Age: Competing on the Final Economic Frontier*. Retrieved from https://www.politico.com/f/?id=00000177-9349-d713-a777-d7cfce4b0000
6. Wiki Information (2021). *Space Logistics*. Retrieved from https://en.wikipedia.org/wiki/Space_logistics

Indicative

1. Chris Versace, Lenore Elle & Mark Abssy (2021). *How to Invest in Space: Major Players and Companies to Watch*. Retrieved from https://www.nasdaq.com/articles/how-to-invest-in-space%3A-major-players-and-companies-to-watch-2021-02-12
2. Brigadier General Steven J. Butow, Defense Innovation Unit, Dr. Thomas Cooley, Air Force Research Laboratory & Colonel Eric Felt, Air Force Research Laboratory (2020). *STATE OF THE SPACE INDUSTRIAL BASE 2020 A Time for Action to Sustain US Economic & Military Leadership in*

Space. Retrieved from http://aerospace.csis.org/wp-content/uploads/2020/07/State-of-the-Space-Industrial-Base-2020-Report_July-2020_FINAL.pdf

3. Stanley K. Borowski, & (2021). *Key Technologies, Systems, and Infrastructure Enabling the Commercialization and Human Settlement of Low Earth Orbit, the Moon, and Cislunar Space*. Retrieved from https://www.liebertpub.com/doi/abs/10.1089/space.2020.0029
4. Space Tech Analytics & (2020). *SpaceTech Industry 2021 / Q2 Landscape Overview.* Retrieved from https://analytics.dkv.global/spacetech/SpaceTech-Industry-2021-Report.pdf
5. Rohaeel Saleem, O. (2020). *Space SPACs Soar as Cathie Wood's ARK Invest Expected To Launch the ARK Space Exploration ETF (ARKX) This Week*. Retrieved from https://wccftech.com/space-spacs-soar-as-cathie-woods-ark-invest-expected-to-launch-the-ark-space-exploration-etf-arkx-this-week/
6. Morgan Stanley Journal (2020). *Capital Flows as Space Opens for Business.* Retrieved from https://www.morganstanley.com/ideas/future-space-economy