Subject Description Form

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Subject Code	AAE6106
Subject Title	Networked Transportation and Air Traffic Systems
Credit Value	Three credit per subject
Level	6
Pre-requisite/ Co-requisite/ Exclusion	N/A
Objectives	This subject will provide students with 1. Classical and modern development in graph theory and networked transportation with applications to urban and air transportation; 2. The knowledge to solve the networked transportation problem; and 3. The ability to analyse the efficiency and effectiveness of transportation network and produce sensible and actionable insight and strategies.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Design mathematical models for transportation networks; and b. Able to solve and analyse solutions for transportation networks; and c. Determine and evaluate the global/local optimal solutions for urban and air transportation problems.
Subject Synopsis/ Indicative Syllabus	**Transportation Networks** – Network structures; Centripetal and centrifugal networks; Point-to-point and hub-and-spoke networks; Detour level in a hub-and-spoke network; Regular network; Small-world network; Scale-free network; Time-space network; Network expansion; Directed graph; Undirected graph. **Distance measures** – Euclidean; Cosine; Manhattan, Minkowski; Chebyshev; Haversine distances; Eccentricity; Radius; Centre. **Networked Transportation and traffic flow** – Assignment problem; Transhipment problem; Shortest path problem; Maximum Flow problem; Minimum cost flow problem; Transportation network efficiency and resilience; Level of network coverages; Connectivity; Multi-modal transportation network. **Networked transportation application** – Airline network design and hub location problems; Airport ground transportation problems. **Convexity, linear programming and convex optimisation problem** – Affine and convex sets; hyperplanes; convex functions and its properties; basic properties of linear programme; fundamental theorem of linear programming.

Teaching/Learning Methodology	Teaching is conducted through lectures and assignment. The basic knowledge, research methodology and theoretical models will be introduced. The understanding of how to address and formulate networked transportation problems by using mathematical modelling and optimization tools is emphasised. Methodology and data analytics skills are taught in class as well as related real-life scenarios.

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lecture	√	√	√

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
1. Assignment	20%	√	√	√
2. Mid-term examination	30%	√	√	√
3. Final examination	50%	√	√	√
Total	100 %			

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

Overall Assessment:

$$0.5 \times \text{Continuous Assessment} + 0.5 \times \text{Final Examination}$$

The continuous assessment (50%) is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus via assignment and mid-term examination. The final examination (50%) will also be considered to assess the students' learning outcome.

Student Study Effort Expected

Class contact:	
▪ Lecture	39 Hrs.
Other student study effort:	
▪ Self-learning/preparation	36 Hrs.
▪ Assignment	36 Hrs.
Total student study effort	111 Hrs.

Reading List and References	1. Bell, M. G., & Iida, Y. (1997). *Transportation network analysis*. Wiley Publications. 2. Boyd, S., Boyd, S. P., & Vandenberghe, L. (2004). Convex optimization: Cambridge university press. 3. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2022). *Introduction to algorithms*: MIT press. 4. Wells, A. T. (2015). *Air transportation: A management perspective*: Ashgate Publishing, Ltd.

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Note: Implementation in Semester 2, 2022/23