Subject Description Form

Subject Code	AAE5102
Subject Title	Operations Research, Resource Planning and Engineering Management in Aviation
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with 1. the main concepts, ideas and techniques of advanced operations research (OR), optimisation methods, resource planning and engineering management in the aviation industry; 2. the essential principles, research methodology, data interpretation and data analysis with case examples in airline and airport operations; 3. outlook of OR development and its importance in aviation operations.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. design and develop mathematical modelling and optimisation algorithms and adopt OR tools in solving engineering problems in airline and airport operations; b. illustrate, interpret and analyse the numerical results; c. evaluate the resource planning and financial requirement in airlines and airport operations critically; and d. determine the optimal solution and alternatives for aviation engineering problems.
Subject Synopsis/ Indicative Syllabus	**Operations research,** Convex optimisation and optimisation methods in aviation engineering problems; Fundamental theorem of linear programming; Relations to convexity; Simplex method; Duality. **Resource planning and engineering management**: Transportation and network flow problems; Minimum cost flow; Maximal flow; Branch-and-bound algorithms; Heuristics; Critical path method and resource planning in aviation project management. **Aviation Engineering applications:** Airline scheduling planning and optimisation; Gate assignment planning and optimisation; Runway scheduling planning and optimisation; Air logistics transportation problem and optimisation; Flight route optimization.

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 problems by using mathematical programming, OR and optimisation algorithms techniques with modern programming language is emphasised. Research methodology, data analytics skills, algorithm design skills and programme methods are taught in class as well as the related real-life scenarios.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
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	d
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. Ashford, N. J., Stanton, H. M., Moore, C. A., Pierre Coutu, A. A. E., & Beasley, J. R. (2013). Airport operations. McGraw-Hill Education. 2. Birge, J. R., & Louveaux, F. (2011). Introduction to stochastic programming. Springer Science & Business Media. 3. Bondy, J. A., & Murty, U. S. R. (1976). Graph theory with applications (Vol. 290). London: Macmillan. 4. Boyd, S., Boyd, S. P., & Vandenberghe, L. (2004). Convex optimization. Cambridge university press. 5. Hillier, F. S. (2012). Introduction to operations research. Tata McGraw-Hill Education. 6. Leon, S. J., Bica, I., & Hohn, T. (1998). Linear algebra with applications (Vol. 6). Upper Saddle River, NJ: Prentice Hall. 7. Michael, L. P. (2018). Scheduling: theory, algorithms, and systems. Springer. 8. Nocedal, J., & Wright, S. (2006). Numerical optimization. Springer Science & Business Media. 9. O'neil, P. V. (2017). Advanced engineering mathematics. Cengage learning.

July 2023