Subject Description Form

Subject Code	AAE3009
Subject Title	Operations Research and Computational Analytics in Air Transport Operations
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	**Pre-requisite:** AAE2004 Introduction to Aviation System and Air Transport Regulation
Objectives	This subject will provide students with 1. The theory, techniques of operations research, convex optimisation, resource planning and capacity constraints modelling in aviation; 2. The knowledge to solve the operations research problem using commercial solvers; and 3. The ability to analyse numerical results to 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 air transport operation problems; b. Obtain the solution via commercial solver with appropriate heuristics and algorithms; c. Illustrate, interpret, and analyse the numerical results and generate solutions and suggestions; and d. Determine the global/local optimal solutions and compare the alternatives for air transport operation problems.
Subject Synopsis/ Indicative Syllabus	**Convexity** – affine and convex sets; hyperplanes; convex functions and its properties; conjugate function, quasiconvex functions, log-concave and log-convex functions; convexity with respect to generalised inequalities. **Linear programming and convex optimisation problem** – Basic properties of linear programme; fundamental theorem of linear programming; simplex method; duality and the duality theorem; sensitivity and complementary slackness. **Constrained minimisation/maximisation** – hyperplanes; extreme points; primal methods, dual and cutting plane methods; primal-dual methods. **Air transport operations and its application** – Convex optimisation and optimisation methods in aviation engineering problems; critical path method and resource planning in air transport operations; air logistics transportation problem and optimisation; exact methods, heuristics; and computational analytics methods and the applications in air transport engineering.

Teaching/Learning Methodology

Teaching is conducted through class lectures and laboratory. The basic knowledge, research methodology and theoretical models will be introduced. The understanding of how to address and formulate problems by using mathematical programming, operations research (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	Intended subject learning outcomes to be covered			
	a	b	c	d
1. Lecture	✓	✓	✓	✓
2. Laboratory	✓	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Assignment / laboratory report	30%	✓	✓	✓	✓
2. Test	20%	✓	✓	✓	✓
3. Final examination	50%	✓	✓	✓	✓
Total	100 %				

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

Overall assessment:

0.50 × End of Subject Examination + 0.50 × Continuous Assessment

The continuous assessment (50%), consists of assignment, laboratory report and test, is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. The final examination assessment (50%) will also be considered to assess the students learning outcome.

<table>
<tr><td rowspan="7">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>33 Hrs.</td></tr>
<tr><td>▪ Laboratory</td><td>6 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study / preparation</td><td>36 Hrs.</td></tr>
<tr><td>▪ Assignments</td><td>36 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>111 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">1. Boyd, S., Boyd, S. P., & Vandenberghe, L. (2004). Convex optimization. Cambridge university press.
2. Hillier, F. S. (2012). Introduction to operations research. Tata McGraw-Hill Education.
3. Leon, S. J., Bica, I., & Hohn, T. (1998). Linear algebra with applications (Vol. 6). Upper Saddle River, NJ: Prentice Hall.
4. Michael, L. P. (2018). Scheduling: theory, algorithms, and systems. Springer.</td></tr>
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