SUBJECT DESCRIPTION FORMS

Core / Compulsory Subjects

for

MSc in Aviation Engineering

Subjects Code	Subject Title
AAE5001	Guidance, Navigation and Advanced Avionics System
AAE5002	Human Factors, Accident Prevention and Aircraft Maintenance
AAE5101	Next Generation Air Traffic Control and Air Traffic Flow Management
AAE5102	Operations Research, Resource Planning and Engineering Management in Aviation
AAE5103	Artificial Intelligence in Aviation Industry
AAE5105	Fleet Management and Aviation Sustainability
AAE5106	Flight Standards and Airworthiness
AAE5107	Aviation Engineering Services and Aircraft Leasing Management*
AAE5201	Aerodynamics and Computational Fluid Dynamics
AAE5202	Advanced Aircraft Structures and Materials
AAE5203	Aircraft Design and Certification
AAE5204	Autonomous Flight - Mechanics and Control
AAE5205	Aircraft Engine Systems and Combustion

* Retitled from AAE5104 Aviation Technical Services and Aircraft Leasing Management effective from Semester 2 of 2023-24.

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Subject Description Form

Subject Code	AAE5001
Subject Title	Guidance, Navigation and Advanced Avionics System
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with the basic knowledge of guidance, navigation their application in advanced avionics systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. develop an understanding of basic concepts of guidance and navigation; b. understand the working principle of the state-of-the-art navigation systems used in aviation and aeronautical systems; c. apply the knowledge to design and develop advanced avionics systems.
Subject Synopsis/ Indicative Syllabus	**Inertial navigation**: the basic principles of inertial navigation; inertial sensors of accelerometer, gyro; inertial navigation algorithms. **Satellite navigation**: the principles of satellite navigation; receiver signal processing; stand-alone positioning and differential positioning. **Emerging navigation technology**: emerging sensors like lidar, camera; vision-based navigation. **Multi-sensor integration**: least squares estimation and Kalman filter; sensor fault detection and exclusion; performance of precision versus integrity under different scenarios. **Advanced avionics system**: applications in civil aviation, e.g., space-based augmentation system; ground-based augmentation system; receiver autonomous integrity monitoring.

Teaching/Learning Methodology

The teaching and learning methods include lectures and tutorials.

Lectures are aimed at providing students with an integrated knowledge required for understanding fundamental concepts in guidance, navigation and advanced avionics systems. Theories and examples will be presented to cover the syllabus.

Tutorials are aimed at enhancing the analytical skills of the students. Examples will be provided to teach students the skills of designing advanced guidance laws and avionics systems. Students will be able to solve real-life problems using the knowledge they acquired in the class.

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

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. Homework	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:

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

The continuous assessment consists of homework and test, which are aimed at evaluating the progress of students' study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.

The final examination is used to assess the knowledge acquired by the students for understanding and analysing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture	35 Hrs.
	▪ Tutorial	4 Hrs.
	Other student study effort:	
	▪ Self-learning	45 Hrs.
	▪ Homework	21 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. Kabamba P.T. and Girard A.R., Fundamentals of Aerospace Navigation and Guidance, Cambridge Aerospace Series, 2014. 2. Nebylov A.V. and Watson J., Aerospace Navigation Systems. John Wiley & Sons, 2016. 3. Collinson R.P.G., Introduction to Avionics Systems, Springer, latest edition. 4. Tooley M, and Wyatt, Aircraft Electrical and Electronic Systems: Principles, Maintenance and Operation, Elsevier Ltd, latest edition.	

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Subject Description Form

Subject Code	AAE5002
Subject Title	Human Factors, Accident Prevention and Aircraft Maintenance
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with 1. the essential concepts, ideas of human factors and accident prevention approaches in pilot training, ATC and aircraft maintenance industries; and 2. the neuroscience and research methodology in assessing human performance and errors.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. relate human cognitive and physical capabilities and limitations to the design of human-machine systems in aviation; b. apply sound methods to identify and analyse sources of human errors for aviation accident prevention; c. design solutions to reduce human errors with consideration for human, hardware, organization, and environmental factors; and d. design human factor experiments and conduct overall human-system design evaluation via neuroscience and research methodology.
Subject Synopsis/ Indicative Syllabus	**Human factors basics:** Human error and threat management**;** Situational awareness, fatigue and stress; Non-technical skills; Crew resource management. **Research methods:** Statistical analysis, Failure modes and effect analysis; Root cause analysis; Error-case removal programme; Cause-and-effect diagram; Fault tree analysis; Subjective Scales; NASA task load index; Subjective workload assessment technique; Cooper-harper rating scale; Situational awareness global assessment technique. **Accident analysis and prevention:** Accident prevention management; Safety assessment, hazard identification and resolution; Integration of system safety and human performance in ATC, pilot and crew; Dirty dozen; **Human factors in aircraft maintenance and inspection:** Maintenance resource management; Line operations safety assessment; Maintenance error and decision aid.

Teaching/Learning Methodology

Teaching is conducted through class lectures and case study. The basic knowledge, research methodology and theoretical models will be introduced. The understanding of how to address and identify the human factors problem and formulate the resolution will be emphasized. Research methodology, case study and analytics skills are taught in class as well as the related real-life scenarios to enhance the teaching and learning abilities.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	√
Case Study		√	√	√

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	30%	√	√		
2. Case study	30%			√	√
3. Final examination	40%	√	√	√	√
Total	100%				

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

Overall Assessment:

$$0.6 \times \text{Continuous Assessment} + 0.4 \times \text{Final Examination}$$

The continuous assessment (60%) is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus via assignment and case study. The final examination (40%) will also be considered to assess the students learning outcome.

Student Study Effort Expected

Class contact:	
▪ Lecture/Case Study	39 Hrs.
Other student study effort:	
▪ Self-learning/preparation	36 Hrs.
▪ Literature study/case study/reading	36 Hrs.
Total student study effort	111 Hrs.

Reading List and References	1. Campbell, R. D., & Bagshaw, M. (2008). Human performance and limitations in aviation. John Wiley & Sons. 2. De Florio, F. (2016). Airworthiness: An introduction to aircraft certification and operations. Butterworth-Heinemann. 3. Dhillon, B. S. (2009). Human reliability, error, and human factors in engineering maintenance. 4. Dekker, S. (2004). Ten questions about human error: A new view of human factors and system safety. CRC Press. 5. Kinnison, H. A. (2013). Aviation maintenance management. McGraw-Hill Education. 6. Rodrigues, C. C., & Cusick, S. K. (2012). Commercial aviation safety. McGraw-Hill Education. 7. Stolzer, A. J., Halford, M. C. D., & Goglia, M. J. J. (2015). Safety management systems in aviation. Ashgate Publishing, Ltd. 8. Tsang, P. S., & Vidulich, M. A. (Eds.). (2002). Principles and practice of aviation psychology. CRC Press. 9. Wiegmann, D. A., & Shappell, S. A. (2017). A human error approach to aviation accident analysis: The human factors analysis and classification system. Routledge. 10. Wise, J. A., Hopkin, V. D., & Garland, D. J. (Eds.). (2016). Handbook of aviation human factors. CRC Press.

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Subject Description Form

Subject Code	AAE5101
Subject Title	Next Generation Air Traffic Control and Air Traffic Flow Management
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with 1. broad understanding of airport, air traffic control and air traffic flow management; 2. the latest development of the Next Generation Air Transportation System (NextGen) and Asia-pacific airport collaborative decision-making (A-CDM); and 3. the essential knowledge in managing air and surface traffic.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. apply techniques to optimise the airport and air traffic capacity; b. understand and establish a review on the effectiveness of an air traffic management system; c. streamline airport, ground and air traffic operations to gain overall turn-a-round efficiency; and d. identify the airline-airport conflict resolution approach and risk management.
Subject Synopsis/ Indicative Syllabus	**Air traffic control and managemen**t: Air traffic management, congestion control and capacity management, aviation system; Air traffic control and air traffic control aids; Seamless air traffic management and air navigation service; Extreme weather operations; airport emergencies. **Runway scheduling and capacity analysis:** Runway capacity analysis; Airport airside and landside structure and layout; First-come first-served heuristics; Runway design and configuration. **Advancement in airspace technology and performance indicators:** Measurement of system performance; Key issue in airport collaborative decision making in Asia pacific; Critical elements of the Next Generation Air Transportation System (NextGen); Performance and concerns of the NextGen; Airspace Technology Demonstration (ATD): ATD-2/ATD-3.

Teaching/Learning Methodology

Teaching is conducted through lectures and case study. Both the basic knowledge and theoretical models are going to be introduced. The understanding of how to address problems by using scientific tools is emphasised. Normally, examples of problem-solving techniques are taught in class and related scenarios are provided to students to enhance their application abilities.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	√
Case Study	√	√	√	

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	30%	√	√		√
2. Case study	40%	√	√	√	√
3. Individual essay	30%		√	√	
Total	100%				

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

Overall Assessment:

1.0 × Continuous Assessment

The continuous assessment (100%) is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus via reading assignment and case study. Individual essay is used to assess the students' capacities of self-study and problem-solving and understanding on a specific topic to fulfil the requirements of working in the aviation industry.

Student Study Effort Expected

Class contact:	
▪ Lecture/Case Study	39 Hrs.
Other student study effort:	
▪ Literature review/case study/reading	36 Hrs.
▪ Self-learning/preparation	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. Cusick, S. K., Cortes, A. I., & Rodrigues, C. C. (2017). Commercial aviation safety. McGraw-Hill Education. 3. De Neufville, R., Odoni, A. R., Belobaba, P. P., & Reynolds, T. G. (2013). Airport systems: Planning, design, and management. McGraw-Hill Education. 4. Horonjeff, R., McKelvey, F. X., Sproule, W. J., & Young, S. B. (2010). Planning and design of airports. McGraw-Hill Education. 5. Wells, A. T. (2007). Air transportation: A management perspective: Ashgate Publishing, Ltd. 6. Young, S. B., & Wells, A. T. (2011). Airport planning and management. McGraw-Hill Education.

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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.

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Subject Description Form

Subject Code	AAE5103
Subject Title	Artificial Intelligence in Aviation Industry
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 artificial intelligence (AI) in the aviation industry; 2. the essential principles, research methodology, data interpretation and data analysis with case examples in airline and airport operations; and 3. outlook of artificial intelligence development and its important in future air traffic and unmanned aircraft system traffic management.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. design and develop AI algorithms or adopt AI tools in solving engineering problems in airline and airport operations; b. illustrate and analysis the knowledge and data pattern generated by the AI-engine; c. master and understand the complex causal relationship and inferences of AI; and d. apply AI techniques for solving aviation engineering problems.
Subject Synopsis/ Indicative Syllabus	**Fundamental of machine learning, data mining, data analytics and artificial intelligence**: Basic soft computing methods, data mining and artificial intelligence algorithms in airline and airport applications; AI and machine learning algorithm design; Data analytics, managerial implications and actionable insights with aviation case studies analysis. **Supervised learning:** Least squares and nearest neighbours; statistical decision theory; Linear methods for regression; Linear discriminant analysis; Classifications; Logistic regression; Separating hyperplanes; Support-vector machine. **Unsupervised learning:** Clustering; Association dimensionality reduction; K-means clustering; KNN; Neural network; Principle component analysis. **Model inference and averaging:** Bootstrap and maximum likelihood methods; Bayesian method; Relationship between the bootstrap and Bayesian inference. **Advancement in artificial intelligence:** Semi-supervised learning algorithmic architecture; Generative adversarial network; Self-trained

<table>
<tr><td></td><td>Naïve Bayes classifier; Reinforcement learning; Q-learning; Model-based value estimation; Deep learning.

Data-driven optimisation and time-series modelling: Air traffic demand forecasting; Flight delay prediction; Operations management and dynamic pricing.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Teaching is conducted through lectures and case study. The basic knowledge, research methodology and theoretical models will be introduced. The understanding of how to address and formulate problems by using mathematical programming, artificial intelligence algorithms, and soft computing 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 using data to enhance their research abilities.

<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="4">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>Lecture</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Case Study</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
</table>
</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1. Assignment</td><td>30%</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Case study</td><td>40%</td><td></td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Project report</td><td>20%</td><td></td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>4. Project presentation</td><td>10%</td><td></td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="4"></td></tr>
</table>

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

Overall Assessment:

1.0 × Continuous Assessment

The continuous assessment (100%) is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus via reading assignment and case study. Project report is are used to assess the students' capacities of self-study and problem-solving and effective communication skills in English so as to fulfil the requirements of working in the aviation industry.
</td></tr>
</table>

Student Study Effort Expected	Class contact:	
	▪ Lecture/Case Study	39 Hrs.
	Other student study effort:	
	▪ Literature review/case study/reading	36 Hrs.
	▪ Self-study/preparation	36 Hrs.
	Total student study effort	111 Hrs.
Reading List and References	1. Barber, D. (2012). Bayesian reasoning and machine learning. Cambridge University Press. 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. (2009). Introduction to algorithms. MIT press. 4. De Neufville, R., & Odoni, A. (2003). Airport systems. planning, design and management. New York: McGraw-Hill. 5. EASA (2020). EASA Artificial Intelligence Roadmap 1.0 published: A human-centric approach to AI in aviation. EASA. 6. Eurocontrol. (2020). FLY AI report – demystifying and accelerating AI in aviation/ATM. Eurocontrol. 7. Guido, S., & Müller, A. (2016). Introduction to machine learning with python (Vol. 282). O'Reilly Media. 8. Marsland, S. (2015*).* Machine learning: an algorithmic perspective. CRC press. 9. Richert, W. (2013). Building machine learning systems with Python. Packt Publishing Ltd.	

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Subject Description Form

Subject Code	AAE5105
Subject Title	Fleet Management and Aviation Sustainability
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with 1. advanced airline fleet management, crew pairing and fatigue management; and 2. the advanced engines types, aviation fuel, emission mitigation strategy, sustainable aviation system in airline aspect.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. design and develop mathematical modelling in resolving airline fleet, crew pairing and aircraft routing problem; b. design and develop proper airline resource planning in profitable manner; c. evaluate the impact of aviation emission and its mitigation strategy; and d. determine airline solution contributing to the societal, economic and global environment factors.
Subject Synopsis/ Indicative Syllabus	**Operations management, fleet and crew management and flight route management**: Airline fleet management, crew management, aircraft routing and sustainability; Aircraft model configuration and serviceability; Air route planning and schedule recovery; Aircraft life cycle and associated legislation; Risk management in airline operation; Human resource management: crew pairing and rostering management. **Sustainable aviation:** Carbon budgets for aviation; Environmental technology and the future of flight; Aviation and the EU emissions trading system; Airport noise control and modelling; Environmental impact of aviation emission; Sustainable aviation system. **Airline strategic planning:** Coalition, competition, integration and substitution; Pricing strategies; Business models of full-service carriers and low-cost carriers; Competition of airline and high-speed rail.

Teaching/Learning Methodology

Teaching is conducted through lectures and assignments. The basic knowledge, research methodology and theoretical models will be introduced.

The understanding of how to address and formulate problems by using mathematical programming, data analytics, and operations research techniques is emphasised. Research methodologies, such as data analytics and mathematical modelling skills, are taught in class as well as the related real-life scenarios using data to enhance their research abilities.

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-study / preparation	66 Hrs.
Total student study effort	105 Hrs.

Reading List and References	1. Abdelghany, A., & Abdelghany, K. (2016). Modeling applications in the airline industry. Routledge. 2. Bazargan, M. (2016). Airline operations and scheduling. Routledge. 3. Bridger, R. (2013). Plane truth: Aviation's real impact on people and the environment. 4. Budd, L., Griggs, S., & Howarth, D. (2013). Sustainable aviation futures. Emerald Group Publishing. 5. Clark, P. (2017). Buying the big jets: fleet planning for airlines. Taylor & Francis. 6. Walker, T., & Bergantino, A. S. (2020). Sustainable Aviation. Palgrave Macmillan. 7. Wu, C.-L. (2016). Airline operations and delay management: insights from airline economics, networks and strategic schedule planning: Routledge.

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Subject Description Form

Subject Code	AAE5106
Subject Title	Flight Standards and Airworthiness
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with 1. the advanced knowledge in the aircraft airworthiness, flight standards, airworthiness and certification; 2. profile and qualification tests for onboard aircraft system and equipment; and 3. legal requirement of airworthiness and the importance of aircraft performance in safe operational aspects.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. conduct documentation and review of legation requirement for flight standards and airworthiness certifications; b. understand and review the aviation safety, quality, maintenance approval and procedures and procedures of certification continuality; and c. implement and conform the relevant regulations in practices.
Subject Synopsis/ Indicative Syllabus	**Airworthiness –** Airworthiness requirement, regulations and standards; Airworthiness directive (AD); Aircraft registration; Type certification; Production of products, parts and appliances; Certificates of airworthiness and permits to fly; Air operation regulation; Renewal of certificate of airworthiness (C of A) issue; Air operator's certification; Certification arrangements with other authorities, human factors and safety management. **Flight standards –** Requirement and criteria for the approval of type rating training; Pilot licences and associated ratings; Low visibility operations; Air operator's certificates requirements; Avoidance of fatigue in aircrews. **Licensing and certification –** Aeromedical matters; Air operator's certificate; Pilot licensing; Aircraft maintenance licensing; Conversion of license among contracting states. **Quality control and assurance –** Joint maintenance management (JMM); Technical arrangement (TA); Maintenance management exposition (MME); airworthiness control procedures; Maintenance support arrangement and contracted-out maintenance.

Accident prevention and analysis – Safety management system (SMS); Accident analysis; Human factors.

Air operator's certificate (AOC) – CAD 360, AOC requirements document; Operation of aircraft, arrangement for maintenance support.

Flight operations – The air operators certificate, organisation and facilities, operations manual, training and testing; Emergency and survival training, cabin safety, safety management.

International and Hong Kong civil aviation – ICAO history, annexes, safety oversight concept, safety oversight system; HK legislation system, basic law of HKSAR, civil aviation ordinance, air navigation (Hong Kong) order; Safe operating environment.

Teaching/Learning Methodology

Teaching is conducted through class lectures and case studies of airworthiness and aircraft performance to the students. The industrial experts will provide several cases and their experiences throughout the teaching and learning in this course.

Teaching/Learning Methodology	Outcomes		
	a	b	c
1. Lecture	✓	✓	✓
2. Case study	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Assignment / Case study	30%	✓	✓	✓
2. Group project	20%	✓	✓	✓
3. Final examination	50%	✓	✓	✓
Total	100 %			

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

Overall assessment:

$$0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}$$

The continuous assessment (50%) is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus via several assignments, case study and group project. The final examination assessment (50%) will also be considered to assess the students learning outcome.

Student Study Effort Expected	Class contact:	
	▪ Lecture	30 Hrs.
	▪ Case study	9 Hrs.
	Other student study effort:	
	▪ Self-study / preparation	36 Hrs.
	▪ Assignments / group project	36 Hrs.
	Total student study effort	111 Hrs.
Reading List and References	1. Hong Kong Aviation Requirements. 2. Airport Planning & Management. Edited by Alexander T. Wells, latest Edition, McGraw Hill. 3. Aircraft Safety: Accident Investigations, Analyses & Applications. Edited by Shari Stamford Krause, latest Edition, McGraw Hill.	

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Subject Description Form

Subject Code	AAE5107
Subject Title	Aviation Engineering Services and Aircraft Leasing Management
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with 1. the operations and management of aircraft leasing industry; and 2. the advanced knowledge of aviation finance, taxation and insurance. 3. the advanced knowledge on the major operational, technical and inventory support functions to the airline industry
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. develop and apply various auditing techniques in the MRO and airline industry**;** b. conduct aviation engineering related incident/event investigation using state-of-the-art methodologies and implement various corrective actions**;** c. define and manage the major engineering operational reliability key drivers**;** d. assess and evaluate the cost effectiveness of various non-mandatory engineering bulletins and their implementation**;** e. apply various strategies and techniques to optimise and implement aircraft maintenance programmes**;** f. understand and apply the various inventory support models to the airline; g. understand the roles and functions of various airlines business in aircraft leasing and aviation financing management; h. evaluate the cost-and-benefit in various aircraft trading modes and aircraft leasing approaches; and i. perform risk assessment and management related to aircraft leasing.
Subject Synopsis/ Indicative Syllabus	**Operational and technical Support**: Technical support functions in maintenance, repair and overhaul; quality assurance audits, audit checklist development, hazard and risk management, management of accident/incident development, implementation and optimisation of maintenance programmes, development and monitoring of operational reliability related key performance indicators, cost-benefit analysis in service bulletin evaluation process, major inventory support models and

<table>
<tr><td></td><td>their implementation;

aircraft leasing management: Aircraft specification review and evaluation; Auditing of aircraft and their records; Aircraft lease management; Operating lease structuring; Sales and leasebacks; Transaction risk assessment; Aircraft acquisition.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Teaching is conducted through class lectures, which are aimed at providing students with the understanding of how to address aviation technical services and aircraft leasing problem and resolve the problem by risk assessment and operational management methods.

<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="9">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td></tr>
<tr><td>Lecture</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
</table>
</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="9">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td></tr>
<tr><td>1. Assignment</td><td>40%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Final examination</td><td>60%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="9"></td></tr>
</table>

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

Overall Assessment:

0.4 × Continuous Assessment + 0.6 × Final Examination

The continuous assessment (40%) is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus via assignment. The final examination (60%) will also be considered to assess the students learning outcome.
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>39 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study</td><td>66 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>105 Hrs.</td></tr>
</table>
</td></tr>
</table>

Reading List and References	1. Anyafo, A. (2018). Buy or Lease Decision in Fixed Assets Acquisition in the Nigerian Civil Aviation Industry. Journal of Administration, 1(1). 2. Coulter, J. M., Redpath, I. J., & Vogel, T. J. (2018). Leasing Agreements in the Airline Industry: A Case Study Examining the Impact of Asu 2016-02. Journal of Business and Educational Leadership, 7(1), 114-123. 3. Donald H. Bunker. International Aircraft Financing (Volume 1 – General Principles and Volume 2 – Specific Documents). 4. Gillen, D., & Morrison, W. G. (2015). Aviation security: costing, pricing, finance and performance. Journal of Air Transport Management, 48, 1-12. 5. Keaveny, C., & Murray, S. (2013). Aviation finance and leasing. Offshore Investment, 239, 12-14. 6. Mann, E. D. (2009). Aviation finance: An overview. Journal of Structured Finance, 15(1), 109. 7. Murphy, R., & Desai, N. (Eds.). (2011). Aircraft financing. Euromoney Books. 8. Morrell, P. S. (2013). Airline finance. Ashgate Publishing, Ltd. 9. Vasigh, B., Fleming, K., & Humphreys, B. (2014). Foundations of airline finance: Methodology and practice. Routledge. 10. Vitaly S. Guzhva, Sunder Raghavan, Damon J. D'Agostino (2018). Aircraft Leasing and Financing: Tools for Success in International Aircraft Acquisition and Management. Elsevier Science. 11. Wensveen, J. (2018). Air transportation: A management perspective. Routledge. 12. Kinnison, Harry A., and Tariq "Terry" Siddiqui (2013). "*Aviation Maintenance Management*. 2nd ed. New York: McGraw-Hill Education.

December 2023

Subject Description Form

Subject Code	AAE5201
Subject Title	Aerodynamics and Computational Fluid Dynamics
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with knowledge of aerodynamics and computational fluid dynamics (CFD). 2. To develop students' capability in theoretical and numerical analysis of canonical aerodynamic problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. acquire fundamental knowledge of aerodynamics and CFD primarily in terms of inviscid flow; b. perform theoretical and numerical analysis of canonical aerodynamic problems; and c. gain basic understanding of state-of-the-art CFD techniques.
Subject Synopsis/ Indicative Syllabus	**Inviscid, incompressible flow**: Laplace equation and elementary solutions; Thin airfoil theory **Inviscid, compressible flow**: Shock and expansion waves; Quasi-one-dimensional flow; Linearized flow; Transonic flow; Hypersonic flow **Basics of numerics**: Finite differences; Difference equations; Stability analysis **Numerical techniques for incompressible flow**: Pressure correction technique **Time-marching techniques for compressible flow**: Lax–Wendroff technique; MacCormack's technique; Stability criterion **Modern CFD techniques**: Upwind schemes; Limiters; Total variation diminishing; Implicit methods

Teaching/Learning Methodology

The teaching and learning methods include lectures and tutorials, which are aimed at providing students with integrated knowledge required for aerodynamics and CFD. Technical/scientific examples and problems will be presented and discussed.

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

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. Homework	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:

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

The continuous assessment consists of homework and test, which are aimed at evaluating the progress of students' study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes and enhancing the integration of the knowledge learnt.

The final examination is used to assess the knowledge acquired by the students for understanding and analysing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial	6 Hrs.
Other student study effort:	
▪ Self-learning	30 Hrs.
▪ Homework	40 Hrs.
Total student study effort	109 Hrs.

Reading List and References	1. Anderson J. D., Fundamentals of Aerodynamics. McGraw-Hill, 6th edition. 2. Anderson J. D., Computational Fluid Dynamics: The Basics with Applications. McGraw-Hill, 1st edition. 3. Bertin J. J. and Cummings R. M., Aerodynamics for Engineers. Pearson, 6th edition.

July 2023

Subject Description Form

Subject Code	AAE5202
Subject Title	Advanced Aircraft Structures and Materials
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Exclusion: ME577 Advanced Aircraft Structures
Objectives	1. To provide students an overview of the structures in modern aircraft. 2. To provide students with tools that are needed to formulate and solve problems concerning compression/tension, bending, torsion and buckling in aircraft structures. 3. To provide students with an overview of the advanced materials that are used for aircraft vehicles. 4. To provide students with an overview of the non-destructive testing techniques that are used to ensure the safe operation of aircraft vehicles.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. perform stress analysis for typical aircraft structural components using both analytical methods and computational tools; b. obtain in-depth understanding of the mechanical behavior of the materials that are used for aircraft vehicles; c. choose the non-destructive testing methods that best suit certain aerospace structural components; and d. recognize the frontier of research in aircraft structures and materials.
Subject Synopsis/ Indicative Syllabus	**Structures**: Fuselage; Wing; Tail; Landing gear; Thin-wall beams; Tapered beams; Ribs; Cut-outs; Loads applied on airframes; Stress analysis of aircraft structural components **Materials**: Typical aircraft materials and material characteristics; Characteristics of composite materials **Non-destructive testing and evaluation of aircraft structures (NDT&E)**: Finite element method (FEM) for the analysis of aircraft structures

Teaching/Learning Methodology

Lectures, tutorials and guided study by project/case study/literature survey are used to deliver the fundamental knowledge and research elements in relation to aircraft structures and materials.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	√
Tutorial/Guided Study	√	√	√	√

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. Project report	20%	√	√		
2. Assignment	40%		√	√	√
3. Final examination	40%	√	√	√	√
Total	100%				

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

Overall Assessment:

$$0.6 \times \text{Continuous Assessment} + 0.4 \times \text{Final Examination}$$

The project report is aimed at enhancing the students' comprehension and understanding of aircraft structures and the state-of-the-art technologies in relevant area. The assignment is used to assess the students' understanding of the stress analysis methods and their capabilities of mathematical problem formulation and programme application for typical aircraft structures. The final examination will be conducted to evaluate the students' performance in all the topics of the syllabus with a limited examination time.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture	39 Hrs.
	Other student study effort:	
	▪ Self-learning	45 Hrs.
	▪ Project report preparation	22 Hrs.
	Total student study effort	106 Hrs.

Reading List and References	1. Sun C. T., Mechanics of Aircraft Structures, John Wiley & Sons, latest edition. 2. Megson, T. H. G., Aircraft Structures for Engineering Students, Elsevier, latest edition. 3. Gibson, R. F., Principles of Composite Material Mechanics, McGraw-Hill, International Editions, latest edition.

July 2023

Subject Description Form

Subject Code	AAE5203
Subject Title	Aircraft Design and Certification
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Exclusion: ME578 Aircraft Design
Objectives	1. To provide students with the key knowledge relevant to the process and principle of aircraft design, and the capacity to formulate the design requirements for an aircraft using modern engineering tools. 2. To provide students with the multi-disciplinary design optimization (MDO) knowledge to conduct aircraft system optimization from aerodynamics, propulsion, structure, stability, and performance perspectives. 3. To provide students with the knowledge about aircraft certification process and requirement.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. understand fundamental concepts and constraints during an aircraft design process; b. evaluate common aircraft configurations; c. design and layout aircraft major components; d. design and sizing aircraft that meets aerodynamic requirements; e. optimize the aircraft design process by multi-disciplinary design optimization principles; and f. understand airworthiness and aircraft certification process during an aircraft design.

<table>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>
Introduction to Aircraft Design: Design process and basic aircraft requirements; Evolution of aircraft design and its performance: a brief history; Overview of aircraft design iteration cycle

Modern Aircraft Configuration: Advantages and drawbacks of conventional and modern configurations; Considerations for special aircraft; Primary considerations for the fuselage, wing, and tail design

Aerodynamic Consideration of Aircraft Design: Fundamentals of aerodynamic; Friction and pressure drag; Airfoil; Finite wings; Drag and lift; Dependence of lift and drag on the angle of attack; End effects of wingtips; Induced drag

Sizing and Costing: Internal layout; Structures and weight; Geometry constraints; Sizing equation; Weight fraction method; Weight and balance; Cost analysis; Elements of life-cycle cost; Cost-estimating methods; Operations and maintenance costs; Cost measures of merit

Main Components Selection and Design: Selection and design of main components such as fuselage, wing, tail and landing gear; Calculation and design of control surfaces such as aileron, elevator and rudder

Multi-disciplinary Design Optimization (MDO): uses optimization methods to solve design problems incorporating a number of disciplines

Aircraft certification and Airworthiness: Airworthiness requirements; Load factor determination; Aircraft safety; Airframe loads; Designing against fatigue; Prediction of aircraft fatigue life
</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>
Lectures are used to deliver the fundamental knowledge in relation to aircraft design. Tutorials and case study are used to illustrate the application of fundamental knowledge to practical situations.
<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="6">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>Lecture</td><td>√</td><td></td><td>√</td><td>√</td><td></td><td>√</td></tr>
<tr><td>Tutorial/Case Study</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
</table>
</td></tr>
</table>

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	e	f
1. Assignment/Test	20%	√	√		√	√	√
2. Design Project	30%	√	√	√	√	√	√
3. Examination	50%	√	√	√	√	√	√
Total	100%						

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

Overall Assessment:

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

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignment, closed-book test and design project. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. Design project is used to assess the students' capacities of self-learning and problem-solving and effective communication skill in English to fulfil the requirements of being aircraft design engineers.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial/case study	6 Hrs.
Other student study effort:	
▪ Course work and design project	42 Hrs.
▪ Self-study	25 Hrs.
Total student study effort	106 Hrs.

Reading List and References

1. Raymer D., Aircraft Design: A Conceptual Approach. American Institute of Aeronautics and Astronautics, Inc., 2018.
2. Torenbeek E., Advanced Aircraft Design: Conceptual Design, Technology and Optimization of Subsonic Civil Airplanes, John Wiley & Sons, 2013.
3. Raymer D., Enhancing Aircraft Conceptual Design Using Multidisciplinary Optimization, Swedish Royal Institute of Technology (KTH), 2002.

Subject Description Form

Subject Code	AAE5204
Subject Title	Autonomous Flight - Mechanics and Control
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with the key knowledge relevant to the flight mechanics, dynamics, and control. 2. To provide students with the capacity to formulate the flight control system by using modern engineering tools and algorithms. 3. To provide students with the knowledge about intelligent planning and control methods to achieve autonomous flight for manned or unmanned aircraft.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. understand fundamental concepts aircraft coordinate systems and forces; b. able to analysis the longitudinal and lateral direction flight mechanics; c. evaluate aircraft flight stability, controllability and handling quality; d. understand classic and modern flight control system; e. understand search-based and sample-based planning methods and trajectory generation methods; and f. extend their knowledge to analyse and develop new modules or algorithms for desired autonomous flight by flight simulation.

<table>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Aircraft Six Degrees of Freedom (6-DOF) Equations of Motion: Aircraft coordinate systems; Kinematic model; Dynamic model; Propulsion system model; Model linearization method

Longitudinal and Lateral Flight Dynamics and Control: Longitudinal motion and mode approximations; Lateral motion and mode approximations; Handling quality

Classic and Modern Flight Control System: Classic flight control system; Modern flight control system; State space modelling; Stability, controllability and observability; State feedback design and optimal control

Planning for Autonomous Flight: Global path planning methods including search-based methods and sample-based methods; Local smooth trajectory generation methods

Autopilot System Integration and Flight Simulation: Open-source flight controller; Flight simulation platform; Programming and hardware interface; Implementation of control and planning algorithms; Introduction to autonomous aerial robotic system</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The teaching and learning methods include lectures, assignment, test, mini project and examination. The tutorials and case study are aimed at providing students with integrated knowledge required for unmanned aircraft systems. Technical/practical examples and problems will be raised and discussed in class/hands on sessions.

<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="6">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>Lecture</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Tutorial/Case Study</td><td>√</td><td></td><td>√</td><td></td><td>√</td><td></td></tr>
</table>
</td></tr>
</table>

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	e	f
1. Assignment/Test	20%	√	√	√	√	√	
2. Mini Project	30%	√	√		√	√	√
3. Examination	50%	√	√	√	√	√	√
Total	100%						

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

Overall Assessment:

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

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignment, closed-book test and mini-project. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. Mini-project is used to assess the students' capacities of self-learning and problem-solving and effective communication skill in English so as to fulfil the requirements of being aircraft design engineers.

Student Study Effort Expected

Class contact:	
▪ Lecture	30 Hrs.
▪ Tutorial/case study	9 Hrs.
Other student study effort:	
▪ Course work and mini project	42 Hrs.
▪ Self-study	25 Hrs.
Total student study effort	106 Hrs.

Reading List and References

1. Pamadi B.N. Performance, stability, dynamics, and control of airplanes. AIAA, 2015.
2. Stevens B.L., Lewis F.L., Johnson E.N., Aircraft Control and Simulation: Dynamics, Controls Design, and Autonomous Systems, Wiley, 2015.
3. Nonami K., Kendoul F., Suzuki S., Wang W., Nakazawa D., Autonomous flying robots: unmanned aerial vehicles and micro aerial vehicles, Springer, 2010.

Subject Description Form

Subject Code	AAE5205
Subject Title	Aircraft Engine Systems and Combustion
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with fundamental knowledge of advanced aircraft engine systems and combustion sciences and their applications in modern gas-turbine engines.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. obtain state-of-the-art knowledge in the areas of aircraft propulsion systems and combustion sciences; b. apply their knowledge, skills and hand-on experience to the design and analysis of aircraft propulsion and combustion systems; c. extend their knowledge of aeronautical engineering to different situations of engineering context and professional practice in propulsions and combustion systems; and d. recognize the need for and an ability to engage in life-long learning.
Subject Synopsis/ Indicative Syllabus	**Introduction to propulsion**: Fluid momentum; Reaction force; Rockets; Propellers; Turbojets; Turboprop; Turbofans. **Review of thermodynamics**: Mass, momentum and energy conservation laws; Thermal properties; First Law of Thermodynamics; *p*-*v*-*T* relation; Ideal gas model; Kelvin-Planck and Clausius statements; Reversible and irreversible processes; Carnot cycle; Clausius inequality; Entropy; Isentropic processes; Isentropic efficiencies; Brayton cycle. **Steady-state, one-dimensional (1-D), compressible flow**: Quasi-1-D flow of perfect gas; Isentropic and non-isentropic flow; Stagnation concept; Nozzle equations. **Propulsion basics**: Thrust equations; Thermal and propulsion efficiencies; Fuel consumption rate and specific thrust; Engine performance; Aircraft range. **Cycle analysis and engine performances**: Turbojet, turbofan, turboprop and turbo-shaft engines. **Subsystems –** Inlets; Turbomachinery: basics of compressors and turbines; Combustors; Nozzles. **Modern aircraft engines:** High-by-pass engines. **Introduction to Combustion**: Combustion modes and flame types; Stoichiometric and equivalence fuel-air ratio; Complete, lean & rich combustion; Elementary of chemical kinetics; Combustor types; Combustor design and flame-holders.

Teaching/Learning Methodology

The teaching and learning methods include lectures, homework assignment, test, and examination. Technical/practical examples and problems will be raised and discussed in class. Project is designed to evaluate the aircraft engine systems.

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. Project	25%	√	√	√	√
2. Homework assignment	25%	√	√	√	√
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 consists of project, homework assignments and tests. They are aimed at evaluating the progress of students' study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.

The examination is used to assess the knowledge acquired by the students for understanding and analysing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lecture	39 Hrs.
Other student study effort:	
▪ Self-Study	67 Hrs.
Total student study effort	106 Hrs.

Reading List and References	1. Thermodynamics: An Engineering Approach, 8th Edition, 2014, by Yunus A. Cengel and Michael A. Boles. McGraw-Hill Education 2. Fluid Mechanics: Fundamentals and Applications, 4th Edition, 2018. Cengel, Y. & Cimbala, J., McGraw-Hill Education 3. Elements of Propulsion: Gas Turbine and Rockets, 2nd Edition, 2006. Jack Mattingl., AIAA. 4. The Jet Engine, 5th Edition, Rolls Royce, WileyAircraft Engine Design, 3rd Edition, Mattingly, J., AIAA. 5. An Introduction to Combustion: Concepts and Applications, 4th Edition, 2021. Turns, S. et al., McGraw Hill. 6. A Gallery of Combustion and Fire, 1st Edition, 2020. Agarwal, A. et al., Cambridge University.

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